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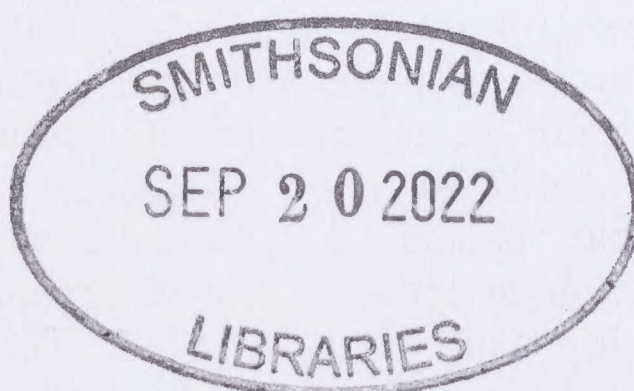
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INTRODUCTION TO CONTRIBUTIONS TOWARD A BRYOFLORA OF CALIFORNIA (AND THE WEST), PART V

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It has been a pleasure to serve as a Guest Editor in the production of this 5th special bryophyte issue published in *Madroño*. Since the first special bryophyte issue appeared in 2004 (Norris and Shevock 2004), nearly 100 mosses have been added to the California bryophyte inventory, just over a 15% increase in species diversity. Of this total, 29 moss species are recently described taxa of which several appeared in *Madroño* (Shevock and Norris 2014; Spence and Shevock 2012, 2015; Spence and Kellman 2015; Brinda et al. 2016; Toren et al. 2016). California and the West remain that portion of the United States where new bryophyte discoveries are guaranteed to be made with ongoing inventory effort. The rate of bryophyte species diversity being discovered and documented is all the more surprising and remarkable considering how few botanists there are in the West who actively conduct bryophyte inventories and prepare high quality bryophyte herbarium specimens.

In this issue, six bryophyte works are presented and in each one, there are species new to science awaiting official publication by other taxonomists or species listed that represent new state records. Rae and Carter provide insights on the distribution of species and habitat specificity for species within two California counties (Napa and San Luis Obispo). Hutton et al. focus their efforts on an inner coast range mountainous area centered within Mt. Diablo State Park, and Shevock et al. explore a conifer dominated wilderness area of a national forest in the Klamath Range. In addition, two bryological works in this issue extend beyond California, the first in adjacent Oregon prepared by Brooks focuses on the Cascade-Siskiyou National Monument, and the second by Kosovich-Anderson provides a bryoflora of the Beartooth Plateau in Wyoming's Yellowstone region.

These six bryological floristic works are based on an examination and acquisition of several thousand herbarium specimens made by the authors and those examined in several herbaria. For many botanists trained and experienced only with vascular plants, conducting a bryophyte inventory can indeed be daunting at the beginning. While bryophyte collecting as a general rule is not season dependent (bryologists have no need to wait for diagnostic features such as the appearance of flowers or fruits like our vascular colleagues), the amount of time

spent to name collections can nonetheless be substantial. While many bryophytes can be recognized and named to species in the field with a bit of training and practice, many closely related species pairs, or similar appearing (yet unrelated) species, can only be positively identified back in the lab with a microscope. Therefore, in doing a bryophyte floristic inventory many samples need to be vouchered to accurately determine the species diversity of the area under study. Stratifying the habitat across the landscape into as many different microhabitats as possible during the inventory process is a critical first step. So all of the species within the study area are likely to be documented with voucher specimens. The good news is no plant press is required to preserve them; they are simply collected in paper packets and air-dried.

Some of the greatest differences between the bryophytes as descendants of the first land plants and the vascular flora is that bryophytes generally have a larger distribution range, and yet populations can be exceedingly disjunct or appear as small occurrences on the landscape. Therefore, localized extirpations can be of greater risk to bryophyte species, even though the taxon as a whole is not rare, threatened, or endangered. Many species here in California and elsewhere across the West, are restricted to or prefer a particular microhabitat, such as bark texture, bark chemistry, seasonal inundation or submersion, specific rock types, or soil pH as just some examples. Many of the species in the various bryophyte works presented in this issue are recorded from only a handful of specimens, and for some species, were collected only once in the study area. Climate change coupled with land use alterations may also increase local bryophyte extirpations, and recolonization would be highly unlikely considering the nearest occurrence may be hundreds of miles away (Burge et al. 2016).

These six bryophyte works contribute to our understanding of species distributions and the specific habitats they prefer. It is amazing how many elevation or new distribution records are reported within these bryofloras that expand on these attributes presented in the Flora of North America (FNA). This is another reason why developing localized bryofloras based on herbarium voucher specimens is so valuable, especially here in the West where far less bryological floristic activities have

occurred compared to the eastern USA. I encourage other botanists and plant enthusiasts to inventory one of their favorite places and determine how the bryophytes are distributed across that landscape and serve as an important component of ecosystem function. These bryophyte floras presented in this issue as well, as those published previously in special bryophyte issue No. 4 in *Madroño* volume 62 in 2015 (available at www.calbotsoc.org), can be studied to ascertain preferred microhabitats, substrate selection, and general distribution attributes of many bryophyte species occurring in western North America.

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A PRELIMINARY CHECKLIST OF THE BRYOPHYTES OF SAN LUIS OBISPO COUNTY, CALIFORNIA

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ABSTRACT

There are currently 192 bryophyte species (156 mosses, 31 liverworts and 5 hornworts) documented from San Luis Obispo County, California. Similar to the vascular flora of the county, the bryophyte flora strongly reflects the transitional nature of the region, which lies near the intersection of the Coast Ranges and Transverse Ranges and supports a large and diverse set of vegetation types. Important floristic and biogeographic patterns include a distinctive suite of species from closed-cone coniferous forests and several noteworthy intrusions of Mojave Desert species into the Coast Ranges. A high proportion of species are known from the county from only one or a few collections, indicating that additional floristic work in the county is very likely to yield new records, with many of these promising to add to the biogeographic significance of the region.

Keywords: biogeography, closed-cone coniferous forest, flora, mosses.

San Luis Obispo County has long been recognized as a region of botanical significance within California (Hoover 1970). The county sits at the southern terminus of the Coast Ranges, with a strong influence from the Transverse Ranges immediately to the south, and it encompasses the full gradient of oceanic influence from coastline to desert areas near the southern tip of the Central Valley. A transect from the northwest corner to the southeast would begin at the southern range limit of the Coastal Redwoods and end in fingers of the Mojave Desert that intrude northward into the California Floristic Province. This climatic and topographic heterogeneity combines with a highly complex geology to foster a rich and well-studied vascular flora, however the bryophyte flora remains relatively poorly known.

The county encompasses approximately 8557 km² (3304 mi²) and sits between the latitudes of approximately 35.8°N and 34.9°N (Fig. 1). Elevations range from sea level along the coast to 1556 m (5104 ft) at the peak of Caliente Mountain in the Caliente Range. Mountain ranges are mostly modest in elevation, with other noteworthy high points around the county including Pine Mountain (1095 m, 3594 ft) in the Santa Lucias northeast of San Simeon, Hi Mountain in Santa Lucias south of Cuesta Pass (969 m, 3180 ft), and Black Mountain (1105 m, 3625 ft) in the La Panza Range. The climate is strongly Mediterranean, and precipitation in the wet season ranges from approximately 100 cm annually in the wettest regions of the northwest to 20 cm in the arid southeastern corner. Coastal fog provides an important supplement to precipitation in coastal areas as well as some of the ridgelines in the interior.

The important topographic features are several mountain ranges that run parallel to the coastline. The largest of these, the Santa Lucia Range, is the

southern end of the prominent range that extends southward from Monterey Bay. The range forms a prominent ridge through the northwestern quadrant of the county and tapers gradually to the south. Around Morro Bay, the Santa Lucias pull away from the coastline and leave behind coastal low-lying areas from Morro Bay through San Luis Obispo to the Nipomo Mesa. To the west of these coastal lowlands is another small range, the San Luis Range. East of the Santa Lucias is the La Panza Range, in the center of the county, and farther east are the Caliente Range and the Temblor Range which form the western and eastern rims of the Carrizo Plain in the southeastern corner of the county.

The geology of San Luis Obispo County, like most regions in the Coast Ranges, is highly complex. A detailed analysis of the geology is presented by Chipping (2016). Much of the western half of the county is underlain by Franciscan *mélange*, a complex of sedimentary and metamorphosed sedimentary rocks that resulted from tumultuous actions of an ancient subduction zone. The result is a broad intermixing of sedimentary sandstones with metamorphosed rock, most notably the serpentinites in the Santa Lucias. Granitic outcrops are also present in the La Panza range and in the geologically unrelated dacite plugs that extend from San Luis Obispo to Morro Bay. The Monterey Formation, made up primarily of thinly interbedded silicious shales and cherts is also common, especially in coastal areas and throughout southern portions of the county. The eastern regions of the county have predominantly sedimentary rocks with multiple geological origins, but also include some basalts and other igneous rocks in the Caliente Range. Relationships of the vascular flora to the various bedrock and resultant soil types have been noted

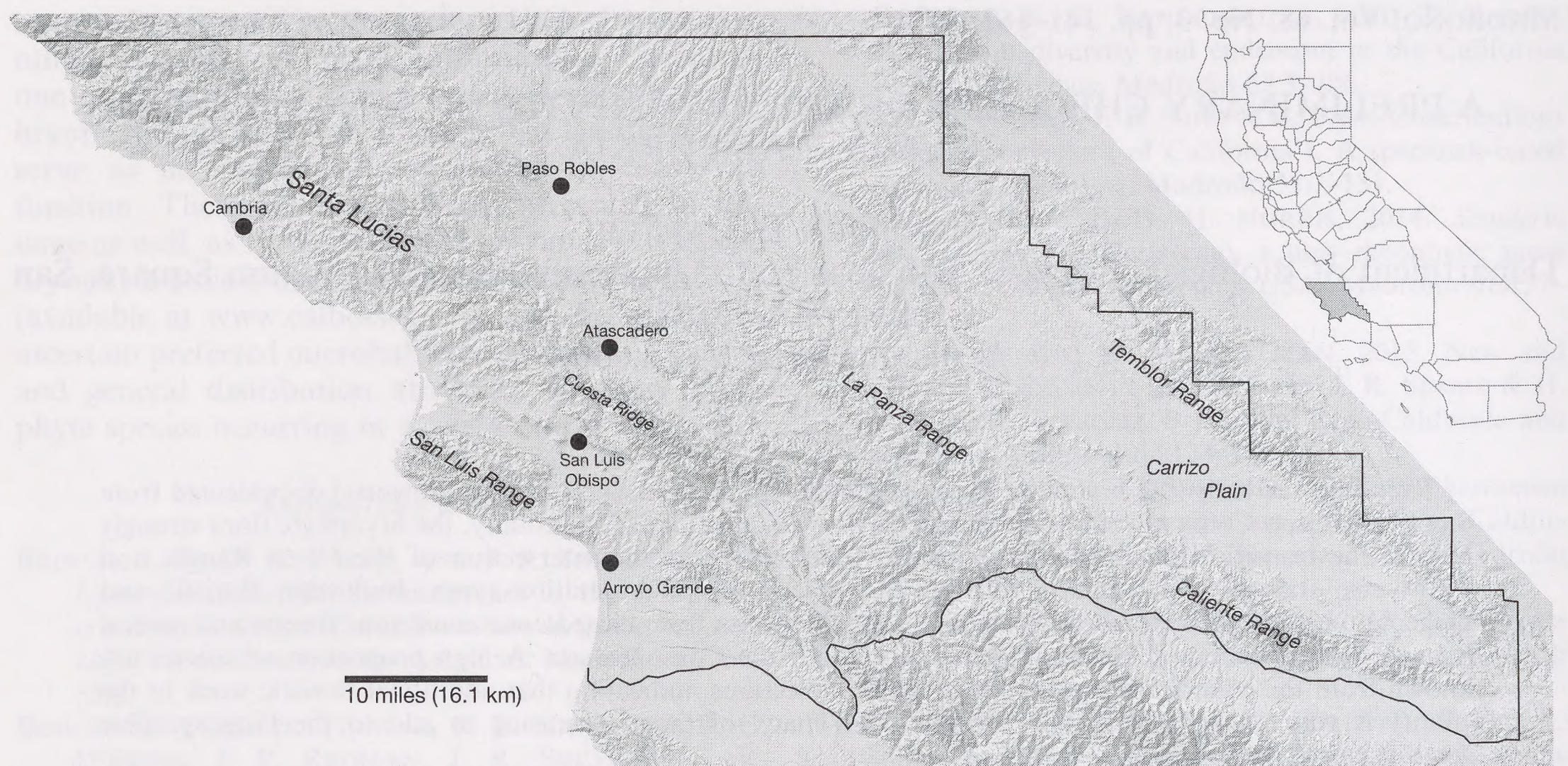


FIG. 1. San Luis Obispo County, California, with important topographic features and cities.

(Hoover 1970), but many of these are of less interest bryologically due to their low suitability for bryophytes (e.g., serpentinite, sandy soils near the coast, salt-laden soils in the interior).

The vegetation of San Luis Obispo County has a complexity aligned with the region's topographic and climatic heterogeneity. A thorough account of the main vegetation types and the characteristic species is provided by Hoover (1970). Coastal areas, including the west slope of the Santa Lucias, include mosaics of *Quercus agrifolia* Née woodland, often with *Umbellularia californica* (Hook & Arn.) Nutt., coastal scrub [*Baccharis pilularis* DC., *Salvia mellifera* Greene, *Toxicodendron diversilobum* (Torr. & A.Gray) Greene, *Diplacus aurantiacus* (Curtis) Jeps. and annual grasslands. In the Santa Lucias, mesic areas can support evergreen forests that also can include *Quercus kelloggii* Newb., *Q. chrysolepis* Liebm., *Acer macrophyllum* Pursh, and *Notholithocarpus densiflorus* (Hook. & Arn.) Manos, C.H.Cannon & S.Oh. At the highest elevations, there are isolated remnants of *Pinus ponderosa* Douglas ex Lawson & C.Lawson forest. East of the crest of the Santa Lucias, woodlands transition to foothill woodlands (*Quercus douglasii* Hook. & Arn., *Q. lobata* Née, *Pinus sabiniana* D.Don) and Blue Oak woodlands (*Q. douglasii*) interspersed with annual grasslands and mosaics of coastal scrub and chaparral. Drier areas transition into mosaics of oak-juniper woodlands (*Q. douglasii*, *Q. john-tuckeri* Nixon & C.H.Mull., *Juniperus californica* Carrière), and chaparral of *Adenostoma fasciculatum* Hook. & Arn., *Ceanothus* L. spp., *Arctostaphylos* Adans. spp., *Eriogonum fasciculatum* Benth., and their associates. The driest interior regions support large areas of arid grasslands and scrub dominated by *Atriplex* L., with pockets, especially in the Caliente Range, of more diverse

assemblages of species typical of the Mojave Desert, for example *Grayia spinosa* (Hook.) Moq. and *Ephedra* L. spp.

Closed-cone coniferous forests do not cover much area in San Luis Obispo County, but are floristically distinctive and are of particular interest bryologically. Monterey Pines (*Pinus radiata* D.Don) have the southernmost of their three stations (also on the Monterey Peninsula and near Año Nuevo) in the forests around Cambria. Bishop Pines (*P. muricata* D.Don) form groves in the San Luis Range, especially above Coon Creek. They form a disjunct station here, with the nearest populations to the north on the Monterey Peninsula and to the south in the vicinity of Point Conception (Santa Barbara County) and on the Channel Islands. Along Cuesta Ridge, there are extensive stands of Knobcone Pine (*Pinus attenuata* Lemmon) south of Highway 101 and stands of Sargent Cypress [*Hesperocyparis sargentii* (Jeps.) Bartel] to the north. The closed cone forests have constraints that are associated with both poor soils and fire ecology (Vogl et al. 1988; Holland and Keil 1994); however, their association with coastal fog, and probably increased levels of soil moisture as a result of fog drip, is most relevant to bryophyte distributions. Cypress stands are not important bryologically, likely as a result of their serpentine substrate, but groves of the three pine species are all important bryologically and are discussed later.

Despite the intriguing ecological features of San Luis Obispo County, it has seen very little bryological attention until the last 20 years. A very small number of collections exist as far back as the 1880s, but real collecting in the area only began with several collecting trips by D. Norris (mostly mosses) and W. Doyle (mostly liverworts) in the early 2000s. My own

collections are primarily from 2004-2007, with more sporadic collecting continuing through 2019. The most important herbaria for bryophytes of San Luis Obispo County are the C.W. Sharsmith Herbarium at San Jose State University (SJSU) and the University of California Herbarium at Berkeley (UC), with smaller numbers of specimens at the California Academy of Sciences (CAS) and the Hoover Herbarium at California Polytechnic State University, San Luis Obispo (OBI). A few of the early specimens are also found at DUKE and F.

METHODS

The list here is based primarily on specimens housed at SJSU, UC and CAS. Fieldwork for the project produced approximately 1800 new specimens. The Consortium of North American Bryophyte Herbaria (<https://bryophyteportal.org/portal/>) was consulted regularly to search for additional collections not at the three herbaria mentioned above. Full label data for the new collections, and most of the other collections cited here, are searchable in the Consortium's online database.

Nomenclature for mosses mostly follows the *Flora of North America*, volumes 27 and 28 (Flora of North America Editorial Committee 2007, 2014). For liverworts and hornworts without treatments in the provisional FNA volume 29 (Flora of North America Editorial Committee *in prep.*), the recent North American synopsis by Stotler and Crandall-Stotler (2017) was followed. In some cases, nomenclatural or taxonomic changes have been proposed since the publication of the FNA volumes, and in those cases details on the differences of opinion are included in the notes on those species. Nomenclatural or taxonomic differences between this treatment and the California flora by Norris and Shevock (2004a, 2004b) are also mentioned to facilitate use of those resources.

RESULTS

A total of 192 bryophyte species are reported here: 156 moss species (representing 24 families and 65 genera), 31 liverwort species (14 families, 15 genera), and 5 hornwort species (2 families, 3 genera). While many noteworthy occurrences are documented here, it is clear that sampling remains incomplete, with 48 (24%) of species known from a single specimen and 109 (55%) of species known from fewer than five collections.

The phylogenetic distribution of species in the county is typical of southern California and other regions with strongly Mediterranean climates, with high proportions of species from lineages known for strong desiccation tolerance and poor representation of lineages adapted to cool or humid environments. The family with the most species currently known is Pottiaceae (54 spp.), followed by Bryaceae (22),

Brachytheciaceae (15), Orthotrichaceae (13), Grimmiaceae (10), Ricciaceae (9) and Funariaceae (6).

Currently, no species are known to be endemic to San Luis Obispo County, which is unsurprising given the generally low endemism in bryophytes relative to vascular plants (Carter et al. 2016). There are, however, a number of records of biogeographic significance. Examples are mentioned briefly here and then presented in context in the discussion. Prominent northern species for which San Luis Obispo County appears to harbor the southernmost currently known occurrence include *Rhytidiadelphus loreus* (Hedw.) Warnst., *Bucklandiella heterosticha* (Hedw.) Bedn.-Ochyra & Ochyra., and *Kindbergia oregana* (Sull.) Ochyra. Additional species for which San Luis Obispo occurrences represent either the southern tip of the contiguous range (with disjunct populations to the south) or represents one of several outlying southern disjunct populations include *Atrichum selwynii* Austin, *Pseudobraunia californica* (Lesq.) Broth., and *Zygodon rupestris* Schimp. ex Lorentz. Species that appear to reach either their western boundary or occur as one of only a few disjunct Coast Range populations from the Mojave Desert include *Syntrichia caninervis* Mitt., *Grimmia orbicularis* Bruch ex Wilson, *G. anodon* Bruch and Schimp., and *G. moxleyi* R. S. Williams. Two important species extending northward along the coast from a more southern distribution are *Frullania catalinae* A. Evans and *Tortula californica* E. B. Bartram, both of which extend northward through San Luis Obispo County to disjunct occurrences in Monterey County.

DISCUSSION

The overall bryophyte richness of San Luis Obispo, as currently understood, is generally consistent with expectations established by other regional floras. Bryophyte richness declines steeply along a latitudinal moisture gradient in California (Norris and Shevock 2004b), with the pattern particularly evident in liverworts (Doyle and Stotler 2006). Bryophyte richness in southern California appears also to be strongly related to elevation or topographic heterogeneity based on an analysis of the Channel Islands (Carter and Guillems 2018). Given the relatively low latitude and minimal areas of high elevation (e.g., relative to bordering Santa Barbara and Monterey counties), the expectation is that richness relative to area would be modest as compared to coastal floras farther north. This is generally borne out, with 156 mosses currently known from San Luis Obispo as compared to 300 mosses known from Lake County (Toren 2015), 191 mosses from Santa Cruz County (Kellman 2003), and 123 mosses from Marin County (Yurky 1995). The only recent southern California floras are from the Channel Islands, which have 158 bryophyte species (including liverworts and hornworts) and the Santa Monica Mountains with 119 bryophytes,

as compared to the 192 bryophytes in the much larger San Luis Obispo County. Together, these support the pattern of a reduction in bryophyte richness with latitude along coastal California, but the low number also strongly suggests that San Luis Obispo County remains under-collected.

Phylogenetic patterns in the San Luis Obispo flora also support trends developing from recent floras in southern California (Sagar 2007; Carter 2015). The most obvious is the high proportions of desiccation tolerant lineages including Pottiaceae, Bryaceae, Brachytheciaceae, and Orthotrichaceae. Also significant is the importance of coastal fog, which supports the presence of a smaller number of ecologically and phylogenetically very different lineages, including leafy liverworts, Lembophyllaceae and Dicranaceae. This is particularly evident in comparisons among the floras of coastal San Luis Obispo, the northern Channel Islands (Carter 2015) and the Santa Monica Mountains (Sagar 2007), the last of which lacks closed-cone coniferous forests and other vegetation types associated with moisture supplemented by coastal fog. A third pattern that is becoming very clear is support for the notion that the primary biogeographic pattern in the Coast Ranges of California is one of a gradual decline in richness from north to south. This has been noted by observation of southern range limits in northern California (Norris 1997), a pattern of nestedness rather than turnover between north and south Channel Islands (Carter and Williams 2018), and in broad patterns of endemism across the west coast of North America (Carter et al. 2016). There are clearly other important patterns, for example *Syntrichia caninervis* Mitt., and several other Pottiaceae and *Grimmia* Hedw., extending westwardly to the inner Coast Ranges from the Mojave Desert; however, this desert element appears to be less important than the broad latitudinal decline in moisture availability.

Similar to the vascular flora (Hoover 1970), the bryophyte flora of San Luis Obispo presents a clear pattern of transition with elements from the mesic north coast to the arid deserts and the semiarid south coast. The patterns are somewhat muted relative to patterns in the vascular flora, however, with only a few species representing each of these elements. Stronger patterns may emerge with future collecting, and further work in San Luis Obispo County, as well as in underexplored Monterey County to the north and Santa Barbara County to the south. Comparisons of the three counties will increase our understanding of the importance of the central coast as a region in which to understand range limits, spatial heterogeneity, and beta diversity of bryophytes.

Closed-cone pine forests of San Luis Obispo, and southern California more broadly, appear to represent important relictual areas for bryophytes that may yield useful information about impacts of warming and drying climates in coastal California on bryophyte distributions. The potential bryological

significance of closed-cone pine forests has been pointed out earlier, both in the context of the anomalous distribution of *Campylopus introflexus* (Hedw.) Brid. in California (Carter 2014) as well as important relictual areas for bryophytes on the northern Channel Islands (Carter 2015). In San Luis Obispo County, three species, all of which are common to the north, appear to have their southernmost occurrences in closed-cone forests. These are *Kindbergia oregana* (Sull.) Ochyra in the Monterey Pine Forest near Cambria, *Bucklandiella heterosticha* (Hedw.) Bedn.-Ochyra & Ochyra in the Knobcone Pine forest along Cuesta Ridge, and *Rhytidiadelphus loreus* (Hedw.) Warnst., in the Bishop Pine Forest above Coon Creek. Additional common northern species that are restricted to closed-cone forests in San Luis Obispo County, with only one or a few additional southern populations (in some cases bishop pine forests on the Channel Islands) include *Atrichum selwynii* Austin (Monterey pine), *Pseudobraunia californica* (Lesq.) Broth. (Knobcone Pine), *Hedwigia stellata* Hedenäs (Knobcone Pine and adjacent sites), *Isothecium stoloniferum* Brid. (Bishop and Monterey Pine), *Lophocoloea bidentata* (Bishop Pine), *Isothecium cristatum* (Bishop and Monterey Pine), and *Lophocoloea bidentata* (L.) Dumort. (Bishop Pine). A third group of species, including *Aulacomnium androgynum* (Hedw.) Schwägr., *Marsupella bolanderi* (Austin) Underw., and *Ditrichum schimperi* (Lesq.) Kunze are more widespread but appear, based on current understanding, to be restricted (*Aulacomnium* Schwägr., *Marsupella* Dumort.) or nearly restricted (*Ditrichum* Bruch & Schimp.) to closed-cone forests within the study area.

The county also harbors several occurrences of species common to the Mojave Desert that either find their northwestern limit in the vicinity of Carrizo Plain or extend discontinuously up the Inner Coast Range. Further collecting, especially in Monterey, San Benito, and northern Santa Barbara counties is needed to clarify these distributions. *Syntrichia caninervis*, the ubiquitous soil moss of the Mojave Desert, is a prime example with occurrences in Carrizo Plain and then disjunct localities through San Benito County and as far north as Lake County (Toren 2015). Two common desert *Grimmia* Hedw., species, *G. moxleyi* R. S. Williams, and *G. anodon* Bruch & Schimp., have roughly similar distributions with stations near Carrizo Plain and then scattered localities in the South Coast Ranges. *Grimmia orbicularis* Bruch ex Wilson also has a similar distribution, but so far is only known in the Coast Ranges from around Carrizo Plain.

Because of the strong richness gradient from north to south in California, the proportion of species common along the south coast and tapering off to a northern limit in the South Coast Ranges is very low. Two species that exhibit this pattern are common on the Channel Islands, sporadic along the south coast, where they may be either under-collected or suffer from habitat loss, and then extending into San Luis

Obispo and Monterey counties. These are *Tortula californica* E. B. Bartram and *Frullania catalinae* A. Evans, both of which are found in the San Luis Range and in coastal lowlands around the city of San Luis Obispo and then have one or more disjunct occurrences in coastal Monterey County. Interestingly, these southern species are not adapted to arid environments, but are restricted to fog-drenched coastal areas throughout their ranges. It remains unclear why they do not exist farther north where these conditions are more common.

Priorities for future work

The work leading up to this flora is admittedly preliminary, but highlights areas, both taxonomic and geographic, that will likely be productive with further investigation. There is little doubt that further exploration of the northwest corner of the county, the coastal closed-cone coniferous forests, and the Caliente Range will yield new discoveries that will help to clarify bryophyte biogeography of the South Coast Ranges. The northwest corner of the county is almost completely unknown bryologically as a result of the high proportion of private property, but it is a well-known region of vascular plant endemism (Hoover 1970) that would likely yield occurrences important to our biogeographic understanding of the broader region. Many of the liverwort collections, for example, are from roads that cut across the Santa Lucias from Cayucos and San Simeon to Atascadero and Paso Robles, and it seems likely that exploration of the less accessible areas in that region would be highly productive. Ecologically, springs and seasonally wet areas, especially in the La Panza range and other interior areas, certainly warrant further exploration, especially with respect to improving the understanding of Bryaceae throughout the county.

Taxa that appear to be both diverse and undercollected in the county include *Gemmabryum* J. R. Spence, *Riccia* L., Funariaceae (especially *Entosthodon* Schwägr.), and *Didymodon* Hedw. The same could be said of these four lineages throughout the Coast Ranges more broadly, but San Luis Obispo appears to offer a healthy proportion of challenging specimens from these genera, suggesting that future work in the field and the herbarium would be productive.

Vouchered catalog of the bryophytes of San Luis Obispo County

In the following list, five geographically representative vouchers are listed for common species with more than five vouchers in herbaria. The list includes all known vouchers for species that are known from fewer than five collections. Specimens collected by the author are housed at the C. W. Sharsmith Herbarium unless otherwise noted. Vouchers collect-

ed by others include the herbarium code in parentheses.

MOSSES

Amblystegiaceae

Amblystegium serpens (Hedw.) Schimp.

Along creeks, and as a lawn weed west of the Santa Lucias. Uncommon.

Some specimens match the description of *A. juratzkanum* Schimp., but following Vanderpoorten (2014), this taxon is not recognized as distinct from *A. serpens*.

Reservoir Canyon. *Carter* 280; Arroyo Grande Creek in historic downtown Arroyo Grande. *Carter* 726; Poly Canyon. *Carter* 10323. Osos Street, Southeastern San Luis Obispo. *Carter* 788.

Leptodictyum riparium (Hedw.) Warnst.

Growing seasonally submerged in creeks in the Santa Lucias. Uncommon.

Little Falls Trail in Lopez Canyon. *Carter* 321, *Carter* 331; Hi Mountain Rd below Hi Mountain lookout. *Carter* 778.

Platyhypnum bestii (Renauld & Bryhn) Ochyra

[*Hygrohypnum bestii* (Renauld & Bryhn) Holzinger] West slope of Santa Lucias. Seasonally submerged in seasonal streams. Rare, known from a single occurrence.

Reservoir Canyon. *Carter* 295.

Aulacomniaceae

Aulacomnium androgynum (Hedw.) Schwägr.

On decaying or burned wood in closed-cone pine forest, growing in Monterey, Bishop, and knobcone stands. Occasional there, not known in San Luis Obispo County from other vegetation types (but commonly occurring north of the county and in the conifer zone of higher mountains).

Scott's Rock, east of Cambria. *Carter* 440; Diablo Canyon, in the San Luis Range. *Carter* 1336; Bob Kerr Nature trail Southwest of Cambria. *Carter* 1384; East Cuesta Ridge. *Carter* 1400; Rancho Marino Reserve south of Cambria. *Carter* 1511.

Bartramiaceae

Anacolia baueri (Hampe) Paris

From the immediate coast to the Temblor Range, primarily on soil or outcrops in grasslands and open woodlands or chaparral. Common. Some workers (e.g., Norris and Shevock 2004a, 2004b) recognize two species, *A. menziesii* (Turner) Paris and *A. baueri*, based on differences in the capsule shape, whereas others lump *A. baueri* under the name *A. menziesii* (e.g., Griffin 2014). Specimens from San Luis Obispo County rarely produce sporophytes. All specimens that do have sporophytes possess the more cylindrical sporophytes of *A. baueri*. Specimens cited here all

have sporophytes, but numerous sterile collections of *Anacolia* from throughout the county have also been studied.

North of Rock Ranch, off Hwy 166. *Carter* 1585; Hi Mountain Rd, above and to the east of Trout Creek. *Carter* 762; East Cuesta Ridge, 1415; Cypress Mountain Rd, *Carter* 10495.

***Bartramia aprica* Müll.Hal.**

[*Bartramia stricta* Brid., misapplied]

Coastal areas and the west slope of the Santa Lucias, on soil in grassy areas and open woodlands. Occasional.

Scott's Rock, just east of Cambria. *Carter* 439; California Polytechnic State University, Poly Canyon Rd. *Carter* 1075; Stagecoach Rd, just below Cuesta Pass. *Carter* 1189; See Canyon Rd. *Carter* 102; Reservoir Canyon, *Shevock* 53723 (CAS), det. Toren 2019.

***Philonotis capillaris* Lindb.**

West slope of the Santa Lucias north of Morro Bay, on soil among grasses in open woodlands. Uncommon. These appear to be the southernmost known occurrences of this species along the Pacific coast.

Cypress Mountain Rd. *Carter* 1307; Hwy 46 near York Mountain Rd. *Carter* 10472.

Brachytheciaceae

***Brachytheciastrum velutinum* (Hedw.) Ignatov & Huttunen**

[*Brachythecium velutinum* (Hedw.) Bruch & Schimp.] Central and southern Santa Lucias and the La Panza Range, on soil in oak woodlands and chaparral. Occasional.

Las Pilitas Rd, near junction with Pozo Rd. *Carter* 975; Santa Margarita Lake along trail on southwest side of the lake. *Carter* 1045; Los Berros Canyon, along Upper Los Berros Canyon Rd. *Carter* 1535; Little Falls Trail in Lopez Canyon, about one half mile from trailhead. *Carter* 325; Queen Bee Campground, Los Padres NF. *Norris* 55154 (UC).

***Brachythecium albicans* (Hedw.) Schimp.**

West slope of the Santa Lucias north of Morro Bay, on shaded soil banks, and as a lawn weed in San Luis Obispo. Uncommon. Specimens attributed to this taxon in the area are frequently misidentified specimens of *Scleropodium* spp. or *Homalothecium arenarium*.

York Mountain Rd., off Hwy 46. *Carter* 10464; California Polytechnic State University Campus, lawn weed. *Carter* 616.

***Homalothecium aeneum* (Mitt.) E.Lawton**

Santa Lucias to the Caliente Range, most common in the interior, on rocks or less commonly soil in open to dense woodlands. Occasional.

Park Hill Rd, south of junction with Las Pilitas Rd. *Carter* 992; Chimeneas Ranch in the mountains southwest of Soda Lake. *Carter* 1138; Cuesta Ridge east of Cuesta Pass, near large radio tower complex.

Carter 1421; Los Padres NF, just north of Rock Ranch entrance off Hwy 166. *Carter* 1909; Hwy 46 near York Mountain Rd. *Carter* 10467.

***Homalothecium arenarium* (Lesq.) E.Lawton**

Immediate coast inland to the Caliente Range on soil, commonly in grassy areas, in grasslands, open woodlands and coastal scrub. Abundant west of the Santa Lucias, occasional inland.

Nipomo Mesa. *Carter* 265; California Polytechnic State University, along Stenner Creek Rd., *Carter* 1450; Rinconada Trailhead, east side of Santa Lucia Mtns. *Carter* 1025; Chimeneas Ranch in the mountains southwest of Soda Lake. *Carter* 1151; Lake Nacimiento, Rocky Canyon Campground. *Carter* 10772.

***Homalothecium aureum* (Spruce) H.Robinson**

[*H. pinnatifidum* (Sull. & Lesq.) E.Lawton]

Santa Lucias to the Temblor Range, typically growing on soil among grasses, less commonly on rock outcrops. In woodlands and chaparral. Common in interior areas, occasional in the Santa Lucias. Hi Mountain Rd below Hi Mountain lookout. *Carter* 783; Black Mtn., Los Padres NF. *Carter* 1656; Temblor Range, along Hwy 58. *Carter* 1793; Cerro Alto Campground, Los Padres NF along Hwy 41. *Carter* 1834; East slope of Caliente Range above Carrizo Plain. *Carter* 3331.

***Homalothecium nuttallii* (Wilson) A.Jaeger**

From coastal areas, through the La Panza Range. On bark of oaks (especially Valley Oaks) and other hardwoods. Common.

Hi Mountain Rd, east of Lopez Lake. *Carter* 731; Oak View Rd., off Hwy 46 west of Paso Robles. *Carter* 1274; Los Berros Canyon, along Upper Los Berros Canyon Rd. *Carter* 1527; Irish Hills, off Perfumo Canyon Rd. *Carter* 9209; Lake Nacimiento, Rocky Canyon Campground. *Carter* 10775.

***Kindbergia oregana* (Sull.) Ochyra**

Known locally only from Monterey and Bishop Pine forests and surrounding areas (including *Eucalyptus* forest). Deeply shaded areas, primarily on soil and leaf litter. Uncommon. These stations apparently represent the southern edge of the distribution of this species, which is common to the north.

Diablo Canyon nuclear power facility (PG&E) property. *Carter* 1349; Rancho Marino Reserve south of Cambria. *Carter* 1510; Santa Rosa Creek near Cambria. *Norris* 68205 (UC); Montana de Oro, *Eucalyptus* Grove. *Norris* 68199 (UC).

***Kindbergia praelonga* (Hedw.) Ochyra**

Coastal areas and the west slope of the Santa Lucias. Shaded riparian areas on soil along streambanks. Occasional.

Little Falls Trail in Lopez Canyon. *Carter* 322; Ragged Point. *Carter* 390; Cypress Mtn. Rd. Serpentine woodland dominated by *Quercus agrifolia*, *Carter* 1312; University of California's Rancho Marino Reserve, Cambria. *Carter* 1512; Los Berros

Canyon, along Upper Los Berros Canyon Rd. *Carter 1531*.

Koponeniella bolanderi (Lesq.) Huttunen & Ignatov
[*Brachythecium bolanderi* (Lesq.) A. Jaeger]

Coastal and northwestern areas, less common in the central Santa Lucias, on soil in woodlands. Uncommon.

See Canyon Rd. *Carter 86*; Klau Mine Rd. near intersection with Adelaide Rd. *Carter 1286*; Queen Bee Campground, Los Padres NF. *Norris 55184 (UC)*; Fiscalini Ranch Reserve, near Cambria. *Carter 10815*.

Scleropodium californicum (Lesq.) Kindb.

Immediate coast to the west slope of the Santa Lucias, rarely east of the Santa Lucias, on soil among grasses or less commonly on bare soil in grasslands, coastal scrub and open woodlands. Common.

Santa Margarita Lake along trail on southwest side of the lake. *Carter 1056*; University of California's Rancho Marino Reserve, south of Cambria. *Carter 1515*; Los Berros Canyon, along Upper Los Berros Canyon Rd., *Carter 1534*; Irish Hills, off Perfumo Canyon Rd. Along Bog Thistle Trail. *Carter 9214*; Cerro San Luis. *Carter 10739*.

Scleropodium cespitans (Müll. Hal.) L. F. Koch

West slope of Santa Lucias and the San Luis Range. On tree bases or rocks, mostly in protected canyons and riparian areas. Common.

Ridge above and to the west of Coon Creek. *Carter 404*; Price Canyon, between San Luis Obispo and Arroyo Grande. *Carter 667*; Northeast Chorro valley on private ranch off San Bernardo Creek Rd. *Carter 1014*; Cerro Alto Campground, Los Padres NF. *Carter 1830*; Hwy 46, near York Mountain Rd. *Carter 10465*.

Scleropodium julaceum E. Lawton

Immediate coast through the Caliente Range, on bare soil in many vegetation types. Common in the interior, occasional on the immediate coast.

Oak View Rd., off Hwy 46 west of Paso Robles. *Carter 1280*; Cerro Alto Campground, Los Padres NF. *Carter 1833*; Chimney Rock Rd, west of Paso Robles. *Carter 9337*; California Polytechnic State University, Poly Canyon. *Carter 10305*; Lake Nacimiento, Rocky Canyon Campground. *Carter 10773*.

Scleropodium obtusifolium (Mitt.) Kindb.

Santa Lucias, seasonally submerged in creeks. Rare, known from a single collection. Easily confused with the much more common *S. occidentale*.

Hi Mountain Rd at northernmost crossing of Trout Creek. In seasonal creek bed. *Carter 774*.

Scleropodium occidentale B. E. Carter

Santa Lucia and La Panza ranges. Seasonally submerged in creeks. Common. The type specimen of this species is from San Luis Obispo County (*Carter 1838*).

Hi Mountain Rd, along Salt Creek. At second creek crossing after NF boundary. *Carter 749*; Black Mtn., Los Padres NF. Ridge Rd leading to summit of Black Mtn. *Carter 1659*; Cerro Alto Campground, along Hwy 41 between Morro Bay and Atascadero. *Carter 1838*; Los Padres NF, just north of Rock Ranch entrance off Hwy 166. *Carter 1912*; Santa Rita Rd. between Cayucos and Templeton. *Carter 10481*.

Scleropodium touretii (Brid.) L. F. Koch

Immediate coast through the La Panza Range. On soil and rocks in trail banks and other lightly disturbed areas in many vegetation types. Abundant. Oak View Rd., off Hwy 46 west of Paso Robles. *Carter 1275*; Klau Mine Rd. near intersection with Adelaide Rd. *Carter 1288*; Bob Kerr Nature trail Southwest of Cambria. *Carter 1386*; Black Mtn., Los Padres NF. *Carter 1651*; California Polytechnic State University, Poly Canyon. *Carter 10308*.

Bryaceae

Bryum argenteum Hedw.

Throughout the county, on compacted soil along trails in all vegetation types, as well as anthropogenic landscapes. Common.

University of California's Rancho Marino Reserve south of Cambria. *Carter 1493*; North of Rock Ranch, off Hwy 166 ca. 26 miles east of junction with Hwy 101. *Carter 1591*; Black Mtn., *Carter 1649*; Temblor Range, along Hwy 58 ca. 500 m west of Kern County line. *Carter 1792*; Rancho Marino Reserve. *Carter 1493*.

Bryum lanatum (P. Beauv.) Brid.

Known only from the city of San Luis Obispo, but possibly overlooked in other areas due to its similarity with *B. argenteum*.

City of San Luis Obispo, Downtown area. *Carter 536*.

Gemmabryum barnesii (J. B. Wood ex Schimp.) J. R. Spence

[*Bryum barnesii* J. B. Wood ex Schimp.]

West slope of the Santa Lucias and coastal areas. Compacted soil in disturbed areas, grasslands, coastal scrub, live oak woodlands. Occasional.

Downtown San Luis Obispo. *Carter 543*; San Simeon State Park. *Carter 800*; San Luis Obispo. *Carter 1204*; West Cuesta Ridge. *Carter 1461*.

Gemmabryum brassicoides J. R. Spence & Kellman

Known only from the Caliente Range, but expected throughout the central part of the county.

Caliente Range, Saucito Springs. *Laeger 677 (CAS)*, det. K. Kellman.

Gemmabryum caespiticium (Hedw.) J. R. Spence

[*Bryum caespiticium* Hedw.]

Known only from Bishop Peak, but undoubtedly more common.

Bishop Peak. *Kellman 7080 (CAS)*

Gemmabryum demaretianum (T. Arts) J. R. Spence
[*Bryum demaretianum* T. Arts]
Known only from Cerro San Luis, but possibly more common.
Cerro San Luis. *Carter* 10722.

Gemmabryum dichotomum (Hedw.) J. R. Spence & H. P. Ramsay
[*Bryum bicolor* Dickson]
Coastal areas and throughout the Santa Lucias on compacted soil in grasslands, woodlands, chaparral, coastal scrub. Common.
Nipomo Mesa. *Carter* 266; West Cuesta Ridge. *Carter* 876; Hwy 58, Los Padres NF. *Carter* 1692; Los Padres NF, Red Hill Rd. *Carter* 10754.

Gemmabryum gemmilucens (R. Wilczek & Demaret) J. R. Spence
[*Bryum gemmilucens* R. Wilczek & Demaret]
Throughout the county on compacted soil in a grasslands, woodlands, chaparral and coastal scrub. Common.
California Polytechnic State University Campus. *Carter* 130; Chimeneas Ranch in the mountains southwest of Soda Lake. *Carter* 1102; University of California's Rancho Marino Reserve south of Cambria. *Carter* 1492; Los Padres NF, Red Hill Rd. *Carter* 10763; Lake Nacimiento, Rocky Canyon Campground. *Carter* 10890.

Gemmabryum radiculosum (Brid.) J. R. Spence
[*Bryum radiculosum* Brid.]
Interior regions of the county, possibly more widespread. On compacted soil.
Santa Margarita Lake. *Carter* 1064; Caliente Range, Padrones Canyon Rd. *Carter* 1540.

Gemmabryum valparaisense (Thér.) J. R. Spence
[*Bryum pyriferum* Crundwell & Whitehouse]
Known only from the west slope of the Santa Lucia, but possibly more widespread. On compacted soil.
Santa Rosa Creek Rd. *Carter* 438.

Gemmabryum vinosum J. R. Spence & Kellman
Throughout the county, in grasslands, oak woodlands, shrublands. On rock outcrops or bare soil. Occasional.
South Hills, San Luis Obispo County Greenspace. Southern San Luis Obispo city. *Carter* 1445; Caliente Range, on north facing hillside above trailhead off Padrones Canyon Rd. *Carter* 1566; Pozo Rd, 1.5 mi. west of Hwy 178. *Norris* 55145 (UC); Valencia Peak, Montaña de Oro State Park. *Carter* 790; Los Padres NF, Red Hill Rd. *Carter* 10756.

Imbribryum microchaeton (Hampe) J. R. Spence
[*Bryum microchaeton* Hampe]
Known only from the west slope of the Santa Lucias. On rocks in flowing water.
California Polytechnic State University Campus, Poly Canyon. *Carter* 10321.

Imbribryum muehlenbeckii (Bruch & Schimp.) N. Pedersen

[*Bryum muehlenbeckii* Bruch & Schimp.]
Throughout the county, On rocks in flowing water. San Simeon State Park. *Carter* 1817; University of California's Rancho Marino Reserve. *Carter* 1499; Calf Canyon, near intersection of Hwy 58 and Hwy 229. *Carter* 1705; Black Mtn. *Carter* 1655.

Imbribryum torenii J. R. Spence & Shevock
Throughout the county, on rocks in flowing water. Occasional.
Hwy 229 at Hwy 58. *Carter* 3; Cerro San Luis Mountain. *Carter* 252; Rd from Pozo Summit to Pine Mountain. *Carter* 942; Chimeneas Ranch, near Soda Lake. *Carter* 1155; Rinconada Falls Trailhead. *Shevock* 53748 (CAS), det. Toren 2019.

Plagiobryoides species A

This is a putative undescribed species (J. Shevock, CAS, personal communication), known from a single collection in the county, which may prove to be more common once it is formally recognized.
Reservoir Canyon, *Shevock* 53726 (CAS).

Ptychostomum pseudotriquetrum (Hedw.) J. R. Spence & H. P. Ramsay ex Holyoak & N. Pedersen
Interior oak woodlands and chaparral, growing in seasonally wet areas and along creeks. Uncommon.
Hwy 229, one mi. north of junction with Hwy. 58. *Carter* 2; Hwy 166, one mi. east of Rock Ranch. *Carter* 1887; Pozo Rd east of summit. *Carter* 242.

Rosulabryum canariense (Brid.) Ochyra

[*Bryum canariense* Brid.]
Throughout the county, growing among grasses in mesic grasslands and oak woodlands. Occasional.
Rancho Marino. *Carter* 1508; Cerro Alto Campground, Los Padres NF. *Carter* 1826; Caliente Range. *Carter* 1564; Temblor Range. *Carter* 1624; Black Mountain. *Carter* 1664.

Rosulabryum capillare (Hedw.) J. R. Spence

[*Bryum capillare* Hedw.]
West slope of the Santa Lucia and coastal areas. On soil, among grasses, less commonly on rock outcrops. Common.
Price Canyon, between San Luis Obispo and Arroyo Grande. *Carter* 668; Cypress Mtn. Rd. *Carter* 1308; Sycamore Mineral Springs, near Avila. *Carter* 675; Hi Mountain Rd. *Carter* 735; East Cuesta Ridge. *Carter* 1395.

Rosulabryum erythroloma (Kindb.) J. R. Spence

[*Bryum erythroloma* (Kindb.) Syed]
Known only from the Monterey Pine Forest in Cambria. On soil. To the south, this species is known only from the Channel Islands, but is to be expected in coastal foggy areas.
Rancho Marino Reserve south of Cambria. *Carter* 1518

Rosulabryum gemmascens (Kindb.) J. R. Spence

[*Bryum gemmascens* Kindb.]
Coastal areas. On soil. Occasional.

Hwy 1 pullout near entrance to Hearst Castle. *Carter 201*; Montana de Oro St Park. *Carter 269*; At the end of Suey Canyon Rd, north of Hwy 166. *Carter 691*; East Cuesta Ridge. *Shevock 53703* (CAS).

Rosulabryum rubens (Mitt.) J. R. Spence
Known from West Cuesta Ridge, but possibly overlooked elsewhere due to its similarity with other *Rosulabryum* J. R. Spence species.
West Cuesta Ridge. *J. R. Spence 6320* (CAS).

Rosulabryum torquescens (Bruch & Schimp.) J. R. Spence
[*Bryum torquescens* Bruch & Schimp.]
Throughout the county. Bare soil or among grasses, or less commonly on rock outcrops in woodlands, grasslands and shrublands. Common.
Near Lopez Lake, between dam and park entrance. *Carter 146*; Hwy 46 about 4 miles east of Hwy 1. *Carter 196*; Highway 41 between Shandon and Creston. *Carter 552*; Rinconada Trailhead, east flank of Santa Lucia Mtns. *Carter 1027*; Oso Flaco Lake. *Carter 338*.

Dicranaceae

Dicranoweisia cirrata (Hedw.) Lindb. ex Milde
Santa Lucia and La Panza Ranges, on decaying or burned wood. Occasional.
Chimeneas Ranch, near Soda Lake. *Carter 1158*; East Cuesta Ridge. *Shevock 53706* (CAS), det. Toren 2019; West Cuesta Ridge. *Carter 1470*; Los Padres NF, along Hwy 58. *Carter 1667*.

Dicranella varia (Hedw.) Schimp.
[*Dicranella howei* Renauld & Cardot]
Coastal areas and into the northern Santa Lucias, on shaded soil banks. Occasional.
Bishop Peak. *Kellman 7067* (CAS); San Luis Creek, east of Avila. *Carter 630*; Santa Rosa Creek, 1 mi. east of Cambria. *Carter 653*; Cypress Mountain Rd. *Carter 1332*; Los Berros Canyon. *Carter 1522*.

Ditrichaceae

Ceratodon purpureus (Hedw.) Brid.
Coastal areas and the Santa Lucias, with occasional occurrences inland, on soil along trails and other disturbed areas. Common. Few specimens have sporophytes, but the majority of those that do are attributable to *C. purpureus* subsp. *stenocarpus* (Bruch & Schimp.) Dixon. All the specimens cited below are this taxon, with the exception of *Carter 115*, which is *C. purpureus* subsp. *purpureus*. The species is represented by many other sterile specimens throughout the county.
Cuesta Ridge, east of Highway 101. *Carter 115, 1396*. Rancho Marino Reserve. *Carter 1519*; Hi Mountain Rd. *Carter 739*; See Canyon Rd. *Carter 802*.

Ditrichum schimperi (Lesq.) Kuntze
Coastal, mesic areas on soil in shaded areas. Occasional.

Ridge above and to the west of Coon Creek. *Carter 405*; Cuesta Ridge, east of Hwy 101. *Carter 123*; Ragged Point. *Carter 391*; Santa Rosa Creek, 1 mi. east of Cambria. *Carter 657*; Rancho Marino Reserve. *Carter 1520*.

Pleuridium acuminatum Lindb.
Widespread from the coast through the La Panza range. On soil in grasslands. Occasional. From the collections examined for this study, *P. acuminatum* appears to have a more coastal, mesic habitat preference, while *P. subulatum* appears to be more common in drier, interior areas.
San Simeon St. Park. *Carter 1821*; Navajo Camp, Los Padres NF. *Bourell 1520* (CAS) det. D. Toren; Camp Roberts Military Reservation. *Norris 100932* (UC); Cuesta Ridge, east of Hwy 101. *Carter 10809*; Red Hill Rd, *Shevock 53727* (CAS).

Pleuridium subulatum (Hedw.) Rabenh.
Santa Lucia and La Panza ranges. On soil in grasslands. Occasional.
Hwy 166 at Clear Creek. *Norris 80658* (UC); Santa Margarita Lake. *Norris 103605* (UC); Lake Nacimiento. *Carter 10788*; Los Padres NF, Red Hill Rd. *Carter 10751*.

Encalyptaceae

Encalypta vulgaris Hedw.
Dry areas from the Santa Lucias eastward. On rocky soil or in rock crevices. Occasional in the Temblor and Caliente Ranges, rare in the La Panza Range.
Chimeneas Ranch in the mountains southwest of Soda Lake. *Carter 1108*; Caliente Range, on north facing hillside above trailhead off Padrones Canyon Rd. *Carter 1555*; Temblor Range, along Hwy 58. *Carter 1791*; Los Padres NF, along Hwy 166. *Carter 1896*; West Cuesta Ridge. *Shevock 53714* (CAS), det. Toren 2019.

Ephemeraceae

Ephemerum serratum (Schreb. ex Hedw.) Hampe
Coastal areas through the Santa Lucias, on soil among grasses, primarily in openings in woodlands and chaparral. Occasional, but likely under-collected.
Hwy 229 at Hwy 58. *Kellman 7631* (CAS); Along Hwy 59 near Wilson Corner. *Norris 77850* (UC); American Canyon Campground, Los Padres NF. *Norris 80713* (UC); Camp San Luis Obispo. *Norris 100873* (UC); Fiscalini Ranch Reserve, near Cambria. *Carter 10820*.

Fabroniaceae

Fabronia pusilla Raddi
Central and coastal areas within the county, on bark (especially within the bark crevices of Valley Oak) and on rock outcrops, where it is mostly on vertical and overhanging surfaces within pockets. Occasional.
Stagecoach Rd, just below Cuesta Pass. *Carter 1199*; Vineyard Rd, west of Paso Robles. *Carter 1284*; Los

Berros Canyon, along Upper Los Berros Canyon Rd. *Carter 1525*; Poly Canyon. *Carter 10318*; Cerro San Luis. *Carter 10731*.

Fissidentaceae

Fissidens bryoides Hedw.

Coastal areas, primarily on shaded, bare mineral soil in closed-cone pine forests. Uncommon.

Santa Rosa Creek, near Cambria. *Norris 68214* (UC); Rancho Marino Reserve. *Carter 1489*.

Fissidens crispus Mont.

Coastal areas and into the Santa Lucias, on soil in grasslands and along trail banks and stream sides. Common.

Arroyo Grande Creek in historic downtown Arroyo Grande. *Carter 724*; Irish Hills, *Carter 9212*; Bishop Peak. *Kellman 7066* (CAS); Santa Rita Rd. between Cayucos and Templeton. *Carter 10488*; Rancho Marino. *Carter 1477*.

Fissidens curvatus Hornsch.

Coastal areas, on soil among grasses in grasslands and openings in coastal scrub and woodlands. Occasional.

Ridge between Avila Beach Drive and coastline, just east of the town of Avila. *Carter 1267*; Cypress Mtn. Rd. near mine. *Carter 1297, 1299*; San Simeon St. Park, along coast near the town of San Simeon. *Carter 1823*; Bishop Peak. *Kellman 7062* (CAS); Cerro San Luis. *Carter 10728*.

Fissidens sublimbatus Grout

Coastal areas and less commonly in the central part of the county, on soil among grasses in grasslands and openings in coastal scrub and woodlands. Occasional.

Upper Pennington Creek. *Carter 903*; Diablo Canyon nuclear power facility (PG&E) property. *Carter 1217*; Red Hill Rd. *Carter 10765*; San Simeon State Park. *Carter 1823*.

Fissidens ventricosus Lesq.

Known from a single collection in Poly Canyon, growing in a seasonally submerged rock crevice. California Polytechnic State University, Poly Canyon. *Carter 10320*.

Funariaceae

Entosthodon attenuatus (Dicks.) Bryhn

Coastal and central areas in the county, on soil in grasslands and openings in woodlands in shrublands. Uncommon.

Camp Roberts Military Reservation. *Norris 100926* (UC), det. D.A. Miller; Los Padres NF, Red Hill Rd. *Carter 10745*.

Entosthodon bolanderi Lesq.

Known from a single collection along the coast below Hearst Castle.

Along Hwy 1, near Hearst Castle. *Carter 200*.

Entosthodon californicus (Sull. & Lesq.) H. A. Crum & L. E. Anderson

Known from Red Hill Rd and the Monterey Pines near Cambria on soil among grasses. The collection from near Cambria matches the morphological description of *E. drummondii* Sull.

Los Padres NF, Red Hill Rd. *Carter 10762*, *Shevock 53729* (CAS), det. Toren 2019; Fiscalini Ranch Reserve, near Cambria. *Carter 10816*.

Funaria hygrometrica Hedw.

Widespread throughout the county on disturbed soils. Common.

Carrizo Plains. *Carter 73*; Nipomo Mesa. *Carter 262*; Caliente Range, near Semper Spring. *Carter 871*; Upper Pennington Creek. *Carter 916*; Lake Nacimiento, Rocky Canyon Campground. *Carter 10784*.

Funaria microstoma Bruch ex Schimp.

Known from a single collection in the southeastern part of the county on bare soil. Easily confused with *F. muhlenbergii* in the field and possibly more widespread.

Hwy 166 at Clear Creek. *Norris 80617* (UC), det. H.A. Miller 2006, *Norris 100904* (UC).

Funaria muhlenbergii Turner

Throughout the county, on soil among grasses in woodland and shrubland openings. Occasional in central and eastern parts of the county, uncommon along the coast. Shell Creek at crossing of Hwy 58, Foothill woodland. *Carter 71*; Cypress Mtn. Rd. *Carter 1310*; North of Rock Ranch, off Hwy 166 ca. 26 miles east of junction with Hwy 101. *Carter 1587*; Carrizo Plain. *Norris 77834* (UC); Lake Nacimiento, Rocky Canyon Campground. *Carter 10778*.

Grimmiaceae

Bucklandiella heterosticha (Hedw.) Bedn.-Ochyra & Ochyra

[*Racomitrium heterostichum* (Hedw.) Brid.]

Known from a single collection from a wet rock slab in the Knobcone Pine Forest along Cuesta Ridge. This is primarily a Pacific Northwest species that has scattered occurrences through northern California extending south to the Santa Cruz Mountains. This station currently represents the southernmost known population of the species.

Cuesta Ridge east of Cuesta Pass, near large radio tower complex. *Carter 1404*, det. J. Shevock 2006.

Grimmia anodon Bruch & Schimp.

Known from a single collection on rocks in desert scrub in the Caliente Range. Though the species is abundant throughout the deserts of western North America, this station is one of only a few recorded from the Coast Ranges of California.

Caliente Range, at trailhead off Padrones Canyon Rd. *Carter 1545*.

Grimmia laevigata (Brid.) Brid.

Throughout the county on sunny rock outcrops. Common in central and eastern parts of the county, occasional in coastal areas.

Cerro San Luis Mtn., near San Luis Obispo *Carter 261*; Rinconada Trailhead, east flank of Santa Lucia Mtns. *Carter 1020*; Temblor Range, along Crocker Canyon Rd. *Carter 1622*; Black Mtn., Los Padres NF. *Carter 1657*; Hwy 166 about 1 mi. east of Rock Ranch. *Carter 1883*.

Grimmia lisae DeNot.

Coastal areas through the Caliente Range, on shady or (less commonly) sunny rock outcrops. Abundant. Rinconada Trailhead, east flank of Santa Lucia Mtns. *Carter 1017*; Chimeneas Ranch in the mountains southwest of Soda Lake. *Carter 1117*; Stagecoach Rd, just below Cuesta Pass. *Carter 1187*; Cypress Mtn. Rd, on east side of Santa Lucia axis. *Carter 1318*, *Carter 1323*; Los Padres NF, just north of Rock Ranch entrance off Hwy 166. *Carter 1906*.

Grimmia mariniana Sayre

Known from a single occurrence from East Cuesta Ridge on shale outcrops. East Cuesta Ridge, *Shevock 53710* (CAS), det. Toren 2019.

Grimmia moxleyi R. S. Williams

Caliente and Temblor ranges, with one record from near Black Mountain. On sunny rock outcrops. Uncommon.

This is a common species in the Mojave Desert, and is known from a few widely scattered collections in the south Coast Ranges, extending as far north as Santa Cruz and San Benito Counties.

Temblor Range, Crocker Canyon Rd. *Carter 1635*; Caliente Range, Padrones Cyn Rd. *Carter 1543*; Jct. of roads to Black Mtn. and to Navajo Camp. *Norris 55249* (UC).

Grimmia orbicularis Bruch ex Wilson

Caliente Range, on sunny rock outcrops in desert scrub. Uncommon. This is a species common in the Mojave Desert and not known from the Coast Ranges with the exception of these stations in the Caliente Range.

Caliente Range, at Semper Spring. *Carter 857*; Caliente Range, Padrones Canyon Rd. *Carter 1570*.

Grimmia ovalis (Hedw.) Lindb.

Known from a single collection on rock outcrops in the Santa Lucias at the southern border of the county.

Just north of Hwy 166 near eastern border of Los Padres NF. *Carter 1429*.

Grimmia pulvinata (Hedw.) Smith

Widespread throughout the county on sunny or shaded rock outcrops. Common.

Price Canyon, between San Luis Obispo and Arroyo Grande. *Carter 671*; Cuesta Ridge, west of Cuesta Pass. *Carter 1467*; Cypress Mtn. Rd., near intersec-

tion of road and ridgeline. *Carter 1329*; Hwy 166 about one mile east of Rock Ranch. *Carter 1885*; Temblor Range, along Crocker Canyon Rd. *Carter 1635b*.

Grimmia trichophylla Grev.

Widespread throughout the county on sunny or shaded rock outcrops. Abundant.

Cypress Mtn. Rd., near intersection of road and ridgeline. *Carter 1334*; South Hills, San Luis Obispo County Greenspace. *Carter 1443*; Cuesta Ridge, west of Cuesta Pass. *Carter 1475*; Caliente Range, above trailhead off Padrones Canyon Rd. *Carter 1567*; Park Hill Rd, south of junction with Las Pilitas Rd. *Carter 984*.

Hedwigiaceae

Hedwigia detonsa (M.Howe) W. R. Buck & D. H. Norris

Scattered throughout drier central areas of the county, rarely along the coast. Occasional.

Hi Mountain Rd., above and to the east of Trout Creek. *Carter 759*; North of Rock Ranch, off Hwy 166 ca. 26 miles east of junction with Hwy 101. *Carter 1578*; Bishop Peak. *Kellman 7081* (CAS); Lynch Canyon Rd near San Antonio Reservoir. *Norris 85157* (CAS, UC); 1.5 mi west of jct. of roads to Black Mtn. and to Navajo Camp. *Norris 55252* (UC).

Hedwigia stellata Hedenäs

Known from two collections along Cuesta Ridge Cuesta Ridge east of Hwy 101. *Carter 117*; Cuesta Ridge west of Hwy 101. *Shevock 53716* (CAS), det. Toren 2019.

Pseudobraunia californica (Lesq.) Broth.

Known only from rock outcrops in the Knobcone Pine forests along Cuesta Ridge.

Cuesta Ridge east of Cuesta Pass, near large radio tower complex. *Carter 1401*.

Hylocomiaceae

Rhytidiadelphus loreus (Hedw.) Warnst.

Known only from the fog drenched Bishop Pine Forest above Coon Creek, where it grows between hummocks of native *Festuca*. This station is a disjunction from an otherwise northern species that is uncommon south of the California/Oregon border. This represents the southern extent of the species distribution in western North America.

Diablo Canyon nuclear power facility (PG&E) property. *Carter 1348* (SJSU, UC).

Lembophyllaceae

Bestia longipes (Sull. & Lesq.) Broth.

West slope of the Santa Lucias, in deep, shaded canyons. On rocks and tree bases along streambanks. Uncommon. This species is much more common to

the north, but occurs only in the deepest, most mesic canyons in the study area.

Hwy 46 about 4 miles east of Hwy 1. *Carter 195*; Little Falls Trail in Lopez Canyon. *Carter 310*; Cypress Mtn. Rd. *Carter 1325, 10498*; Cerro Alto Campground, Los Padres NF. *Carter 1832*.

Dendroalsia abietina (Hook.) E. Britton ex Broth.

Fog-influenced ridgelines in western parts of the county. On tree trunks. Uncommon. This species is abundant in northern California, but is primarily restricted to tree trunks along foggy ridgelines, mostly along the coast, in the study region.

Cuesta Ridge east of Hwy 101. *Carter 125*; York Mtn. Rd., off Hwy 46. *Carter 10461*; Hi Mountain Rd below Hi Mountain lookout. *Carter 779*; Cypress Mtn. Rd., just north of private campgrounds. *Carter 1315*; Diablo Canyon nuclear power facility (PG&E) property. *Carter 1344*.

Isothecium cristatum (Hampe) H. Rob.

Known only from foggy areas in the San Luis Range, on logs and boulders. Occasional in these areas. This is a species common in northern California that is restricted to only foggy, coastal areas in the study area.

Ridge above and to the west of Coon Creek. *Carter 415*; North facing side of ridge between Avila Beach Drive and Avila Beach. *Carter 682*; Diablo Canyon nuclear power facility (PG&E). *Carter 1239*; Montana de Oro St. Park, along Oates Peak Trail. *Carter 1713b*; Fiscalini Ranch Reserve. *Carter 10832*.

Isothecium stoloniferum Brid.

Known only from areas in the vicinity of Bishop Pine and Monterey Pine forests, on logs and leaf litter. Uncommon in these areas.

Alan Peak, Montana De Oro State Park. *Carter 1006*; Diablo Canyon nuclear power facility (PG&E) property. *Carter 408*; Fiscalini Ranch Reserve, near Cambria. *Carter 10829*.

Leptodontaceae

Alsia californica (Hook. & Arn.) Sull.

Coastal areas, on tree trunks or rarely rock outcrops. Common. There is molecular evidence that this species may be better placed within the Neckeraceae under the name *Neckera californica* Hook. & Arn. (Olsson et al. 2011).

Old Creek Rd, northeast of Cayucos. *Carter 187*; Ridge above and to the west of Coon Creek. *Carter 417*; Upper Pennington Creek. *Carter 899*; York Mountain Rd., off Hwy 46. *Carter 10462*; Fiscalini Ranch Reserve, near Cambria. *Carter 10833*.

Leskeaceae

Claopodium whippleanum (Sull.) Renauld & Cardot

Coastal areas through the Santa Lucias on mesic, shaded soil banks, especially north facing slopes and riparian areas. Common.

Hwy 46 about 4 miles east of Hwy 1. *Carter 197*; Hi Mountain Rd at northernmost crossing of Trout Creek. *Carter 773*; Santa Margarita Lake along trail on southwest side of the lake. *Carter 1048*; Stagecoach Rd, just below Cuesta Pass. *Carter 1193*; North of Rock Ranch, off Hwy 166 ca. 26 miles east of junction with Hwy 101. *Carter 1613*.

Leucodontaceae

Antitrichia californica Sull. ex Lesq.

Santa Lucia Range and San Luis Range, especially the northern half of the county, and less commonly into the interior of the county. On tree trunks and less commonly on boulders in oak woodlands. Common.

Little Falls Trail in Lopez Canyon. *Carter 334*; Alan Peak, Montana De Oro State Park. *Carter 1009*; Cypress Mtn. Rd., on east side of Santa Lucia axis. *Carter 1322*; North of Rock Ranch, off Hwy 166 ca. 26 miles east of junction with Hwy 101. *Carter 1604*; Lake Nacimiento, Rocky Canyon Campground. *Carter 10774*.

Nogopterium gracile (Hedw.) Crosby & W. R. Buck. [*Pterogonium gracile* (Hedw.) Smith]

Santa Lucia Range and San Luis Range, on boulders and tree bases in shaded canyons or foggy ridgelines. Occasional.

Santa Margarita Lake, southern shore of lake. *Carter 1061*; Diablo Canyon nuclear power facility (PG&E) property. *Carter 1229*; North of Rock Ranch, off Hwy 166. *Carter 1608*; Montana de Oro St. Park, along Oates Peak Trail. *Carter 1712*; Hwy 46, near York Mountain Rd. *Carter 10466*.

Meesiaceae

Leptobryum pyriforme (Hedw.) Wilson

Coastal areas, in disturbed anthropogenic sites, especially along streambanks or in irrigated horticultural areas. Uncommon.

City of San Luis Obispo, Downtown area. *Carter 541*; Biddle County Park, west of Lake Lopez on Lopez Drive. *Carter 620*.

Mielichhoferiaceae

Epipterygium tozeri (Grev.) Lindb.

San Luis Range and northern Santa Lucias, on soil banks in mesic woodlands. Common.

Cuesta Ridge east of Hwy 101. *Carter 10811*; North facing side of ridge between Avila Beach Drive and Avila Beach. *Carter 683*; Santa Margarita Lake along trail on southwest side of the lake. *Carter 1053*; Diablo Canyon nuclear power facility (PG&E) property. *Carter 1242*; University of California's Rancho Marino Reserve south of Cambria. *Carter 1521*.

Pohlia wahlenbergii (F. Weber & D. Mohr) A. L. Andrews

Primarily in Santa Lucias and coastal regions, and in scattered inland sites. On soil of trail and road banks in mesic areas. Occasional.

Reservoir Canyon. *Carter* 285; Los Osos Creek, Irish Hills. *Carter* 1636; Ragged Point. *Carter* 389; Santa Rita Rd. between Cayucos and Templeton. *Carter* 10486; Salt Creek along Hi Mountain Rd. *Carter* 752.

Orthotrichaceae

Amphidium californicum (Hampe ex Müll. Hal.) Broth.

Santa Lucias, restricted to shady, wet areas in canyons or along ridgelines. Uncommon. Some workers (e.g., Norris and Shevock 2004a, 2000b) treat this genus within the family Rhabdoweisiaceae. North of Rock Ranch, off Hwy 166 ca. 26 miles east of junction with Hwy 101. *Carter* 1607; Cuesta Ridge east of Cuesta Pass. *Carter* 1411; Lopez Canyon. *Carter* 316.

Lewinskya bolanderi (Sull.) F. Lara, Garilleti & Goffinet

[*Orthotrichum bolanderi* Sull.]

San Luis Range, on rock outcrops. Uncommon. San Simeon Creek Rd., at paved low water crossing. *Carter* 452; California Polytechnic State University, Poly Canyon. *Carter* 1161; North of Rock Ranch, off Hwy 166 ca. 26 miles east of junction with Hwy 101. *Carter* 1594; Santa Rita Rd., between Cayucos and Templeton. *Carter* 10483.

Lewinskya rupestris (Schleich. ex Schwägr.) F. Lara, Garilleti & Goffinet

[*Orthotrichum rupestre* Schleich. ex Schwägr.]

Santa Lucias, on rock outcrops in shaded woodlands, with scattered occurrences further inland. Occasional.

Little Falls Trail in Lopez Canyon. *Carter* 332; Upper Pennington Creek. *Carter* 913; Hi Mountain Rd below Hi Mountain lookout. *Carter* 785; Cypress Mtn. Rd. *Carter* 10496; Black Mtn., Los Padres NF. *Carter* 1658.

Orthotrichum cucullatum F. Lara, R. Medina & Garilleti

From the coast to the La Panza Range, On trunks and large limbs of oaks and other hardwoods. Common.

Irish Hills. *Carter* 9205; Old Creek Rd., south of Hwy 46. *Carter* 10493; Hwy 58 near Shell Creek. *Carter* 10770; Lake Nacimiento, Rocky Canyon Campground. *Carter* 10776; Los Padres NF, Red Hill Rd. *Carter* 10766.

Orthotrichum cylindrocarpum Lesq.

[*O. coulteri* Mitt.]

Primarily Santa Lucias, less commonly inland. On trunks and large limbs of oaks and other hardwoods. Common.

Molecular data convincingly separate this species from *O. cucullatum*, *O. franciscanum*, and *O. norrisii*

(Medina et al. 2013). All four of these were until recently lumped under the name *O. tenellum* Bruch ex Brid. Confusion between the names *O. cylindrocarpum* and *O. coulteri* for this species was also recently resolved by Medina et al. (2019).

Hi Mountain Rd, east of Lopez Lake. *Carter* 732; Irish Hills, off Perfumo Canyon Rd. *Carter* 9211; Poly Canyon. *Carter* 10316; Hwy 46 near York Mountain Rd. *Carter* 10468; Santa Rita Rd., between Templeton and Cayucos. *Carter* 10477.

Orthotrichum diaphanum Brid.

Known only from anthropogenic areas in and around San Luis Obispo, on tree trunks. Uncommon.

City of San Luis Obispo in Meadow Park, off of South Street. *Carter* 1447; Camp Roberts Military Reservation. *Norris* 100878 (UC).

Orthotrichum flowersii Vitt

Known only from bark of oak trees in oak-juniper woodland. The distribution of this species is not well understood, but recent collections from the south Coast Ranges and Transverse Ranges suggest that it may not be uncommon in dry oak woodlands, which tend not to be well explored bryologically.

Los Padres NF. Red Hill Rd. *Carter* 10768.

Orthotrichum franciscanum F. Lara, R. Medina & Garilleti

Known from two collections in the Santa Lucias. It is likely under-sampled throughout the Santa Lucias and in coastal areas due to its similarity with other members of the *O. tenellum* complex.

Intersection of Oak View Rd. and Vineyard Rd., west of Templeton. *Carter* 10460; Reservoir Canyon, *Shevock* 53720 (CAS).

Orthotrichum norrisii F. Lara, R. Medina & Garilleti
Throughout the central part of the county, On oaks in oak woodlands. The type specimen of this species is from San Luis Obispo County (*Norris* 55168).

Near San Antonio Reservoir, *Shevock* 32579 (CAS). Queen Bee Campground, *Norris* 55168 (UC); 1.5 mi W of jct. roads to Black Mtn. and that to Navajo Camp, *Norris* 55260 (UC); along Hwy. 166 about 1 mi W of last crossing of Twitchell Reservoir, *Norris* 55280 (UC); along Hwy. 166 at Clear Creek, Los Padres NF, *Norris* 80671 (UC).

Orthotrichum pulchellum Brunt.

Known from a single collection from near the coast, on *Baccharis* twigs in *Eucalyptus* forest.

Montana de Oro. *Norris* 68200 (CAS) det. Lara & Garilleti 2008.

Pulvigeria lyellii (Hook. & Taylor) Plášek, Sawicki & Ochrya

[*Orthotrichum lyellii* Hook. & Taylor]

Eastern half of the county, with scattered occurrences in coastal areas. On large and small tree branches. Occasional. Following other workers in California (e.g., Norris and Shevock 2004a, 2004b), *P. papillosa*

is recognized here as distinct from *P. lyellii* (see below).

Caliente Ridge in Caliente Range. *Carter* 874; Chimeneas Ranch in the mountains southwest of Soda Lake. *Carter* 1118; Stagecoach Rd, just below Cuesta Pass. *Carter* 1197; Temblor Range, along Hwy 58. *Carter* 1796a; Los Padres NF, Red Hill Rd. *Carter* 10767.

Pulviger a papillosa (Hampe) F. Lara, Draper & Garilleti

[*Orthotrichum papillosum* Hampe]

Coastal areas and northern Santa Lucia, extending inland to Santa Margarita area. On large and small tree trunks in woodlands. Common. The closely related *P. pringlei* (Müll. Hal.) F. Lara, Draper & Garilleti, recently recognized as a distinct species from *P. papillosa* (Lara et al. 2020), is not documented, but should be sought in wet coastal areas. Cuesta Ridge, west of Cuesta Pass. *Carter* 1462; Ridge above and to the west of Coon Creek. *Carter* 407; Cerro Alto campground off Hwy 41. *Carter* 9; Rinconada Trailhead, east flank of Santa Lucia Mtns. *Carter* 1021; Santa Rita Rd. between Templeton and Cayucos. *Carter* 10479.

Zygodon rupestris Schimp. ex Lorentz

Known from a single collection on a *Platanus racemosa* Nutt., north of San Luis Obispo. Although this species is fairly widely distributed throughout North America, there are currently no records of this species south of this station in California (e.g., *Carter* 2015; Sagar 2007).

Rancho el Chorro Education Center. *Carter* 10803.

Polytrichaceae

Atrichum selwynii Austin

Known only from bare, shaded soil in the Monterey pine forests near Cambria. This station represents the southern extent of the range of this common northern species within the Coast Ranges, though there is a southern disjunct population known from the Peninsular Range (*Shevock* 41920, CAS).

Bob Kerr Nature trail Southwest of Cambria. *Carter* 1385; Cambria Pines. *H.D. Thiers* 40714 (SFSU).

Polytrichum juniperinum Hedw.

Santa Lucias and coastal areas, and inland to Hi Mountain. On bare soil in openings in shrublands or woodlands. Occasional.

Hi Mountain Rd, east of Lopez Lake. *Carter* 738; Santa Margarita Lake along trail on southwest side of the lake. *Carter* 1046; Ridge trail along ridge between Avila Beach Drive and coastline, just east of the town of Avila. *Carter* 1266; Cuesta Ridge east of Hwy 101. *Carter* 10805; Hwy 46 near York Mountain Rd. *Carter* 10476.

Polytrichum piliferum Hedw.

Santa Lucias and coastal areas, on bare soil in openings in shrublands or woodlands. Uncommon.

North facing side of ridge between Avila Beach Drive and Avila Beach. *Carter* 685; Cuesta Ridge, west of Cuesta Pass. *Carter* 883.

Pottiaceae

Acaulon muticum (Hedw.) Müll. Hal. var. ***rufescens*** (A. Jaeger) H. A. Crum

[*Acaulon rufescens* A. Jaeger]

Central and coastal areas, on soil among grasses in grasslands and woodland understories. Uncommon, but likely overlooked.

Just north of Hwy 166 near eastern border of Los Padres NF. *Carter* 1433; American Canyon Campground, Los Padres NF. *Norris* 80706 (UC); Camp Roberts Military Reservation. *Norris* 100935 (UC).

Acaulon triquetrum (Spruce) Müll. Hal.

Known from a single collection north of San Luis Obispo, but likely overlooked elsewhere.

Camp Roberts Military Reservation. *Norris* 100879 (UC).

Aloina aloides (Koch ex Schultz) Kindb. var. ***ambigua*** (Bruch & Schimp.) E. J. Craig

[*Aloina ambigua* Bruch & Schimp.]

Known from a single collection along the southern border of the county. Bare soil sparse grassland, dry soil banks.

Hwy 166, 17.9 mi east of Hwy 101, along Cuyama River. *Carter* 36.

Aloina bifrons (DeNot.) Delgadillo

Dry interior areas, with one coastal occurrence. Soil in dry scrublands. Uncommon.

Hwy 58 in Open juniper woodland. *Carter* 243; Temblor Range, along Crocker Canyon Rd. *Carter* 1621, 1801; Hwy 166 about one mile east of Rock Ranch. *Carter* 1888; Camp Roberts Military Reservation. *Norris* 100900 (UC).

Barbula unguiculata Hedw.

Coastal areas, in anthropogenic areas in and around San Luis Obispo. Uncommon.

California Polytechnic State University campus. *Carter* 1005; City of San Luis Obispo, Downtown area. *Carter* 548.

Chenia leptophylla (Müll. Hal.) R. H. Zander

[*Leptophascum leptophyllum* (Müll. Hal.) J. Guerra & M. J. Cano]

Coastal areas, on bare soil in disturbed sites. Uncommon.

Santa Rosa Creek above Ferasci Rd river-crossing. *Carter* 656; California Polytechnic State University. *Carter* 1167.

Crossidium aberrans Holzinger & E. B. Bartram

Known only from Carrizo Plains on rock outcrops. Southeast Carrizo Plains along Elkhorn Grade Rd. Southwestern slopes of the Temblor Range on isolated granitic outcrops. *Carter* 1808.

Crossidium seriatum H. A. Crum & Steere

Known from a single collection along the southern border of the county, on soil in dry coastal scrub. Expected in other dry areas around the county. North of Hwy 166 near eastern border of Los Padres NF. *Carter 1423*.

Crossidium squamiferum (Viv.) Jur.
Dry areas in the central portion of the county, on soil in dry woodlands and shrublands. Uncommon, or possibly overlooked.
Hwy 166 about one mile east of Rock Ranch. *Carter 1884*; Pozo Summit. *Norris 55209* (NY) det. C. Delgadillo Moya 1.XII.1995.

Crumia latifolia (Kindb.) W. B. Schof.
Santa Lucias, seasonally submerged in seeps and streams with travertine deposits. Occasional.
Ragged Point. Waterfalls beneath giftshop between Hwy 1 and the ocean. *Carter 396*; Santa Rosa Creek Rd. at crossing of Santa Rosa Creek. *Carter 429*; Hi Mountain Rd at northernmost crossing of Trout Creek. *Carter 766*; Klau Mine Rd. near intersection with Adelaide Rd. *Carter 1292*; Santa Rita Rd., between Cayucos and Templeton. *Carter 10485*.

Didymodon australasiae (Hook. & Grev.) R. H. Zander
Widespread throughout the county, on bare soil in grasslands or openings in shrublands or dry woodlands. Common in the eastern, dry ranges, uncommon in coastal areas.
Chimeneas Ranch in the mountains southwest of Soda Lake. *Carter 1157*; Caliente Range, at trailhead off Padrones Canyon Rd. *Carter 1551*; Temblor Range, along Crocker Canyon Rd. *Carter 1630*; Los Padres NF at junction of roads to Black Mtn. and Navajo Camp. *Norris 55251* (MO) det. Zander; Cerro San Luis. *Carter 10727*.

Didymodon bistratosus Hébr. & R. B. Pierrot
Known from a single collection near Pozo. Expected elsewhere in dry areas with sandstone.
Las Pilitas Rd, near junction with Pozo Rd. *Carter 956*.

Didymodon brachyphyllus (Sull. ex Whipple) R. H. Zander
Throughout the county on dry soils in grasslands or openings in shrublands. Common in the dry eastern areas, uncommon along the coast.
Red Hill Rd. *Shevock 53737* (CAS), det. Toren 2019; Just north of Hwy 166 near eastern border of Los Padres NF. *Carter 1428*; North of Rock Ranch, off Hwy 166 ca. 26 miles east of junction with Hwy 101. *Carter 1616*; Southeast Carrizo Plains along Elkhorn Grade Rd. Southwestern slopes of the Temblor Range on isolated granitic outcrops. *Carter 1809*; Caliente Range. *Laeger 688* (CAS) det. Toren, 2014.

Didymodon eckeliae R. H. Zander
Known from a single collection in Reservoir Canyon on serpentine outcrops.

Reservoir Canyon, *Shevock 53722* (CAS), det. Toren 2019.

Didymodon nevadensis R. H. Zander
Dry areas in the central and eastern areas in the county, on dry soils. Uncommon.
East Ormonde Rd, just north of intersection with Noyes Rd; northeast of Arroyo Grande. *Carter 661*; Trailhead into NF Land, just west of intersection of Hwy 166 and eastern NF boundary. *Carter 707*; Chimeneas Ranch in the mountains southwest of Soda Lake. *Carter 1130*.

Didymodon norrisii R. H. Zander
Throughout the county on dry soils and rock outcrops. Occasional in the drier interior regions, uncommon near the coast.
Los Padres NF, near Hwy 58. *Carter 1686*; Caliente Range, near Semper Spring. *Carter 850*; Just north of Hwy 166 near eastern border of Los Padres NF. *Carter 1438*; Temblor Range, along Crocker Canyon Rd. *Carter 1623*; Camp Roberts Military Reservation. *Norris 100885* (UC).

Didymodon occidentalis (Mitt.) R. H. Zander
[*Didymodon vinealis* var. *rubiginosus* (Mitt.) R. H. Zander]
Known from a single collection in the La Panza Range on dry soils.
1.5 mi west of jct. roads to Black Mtn. and to Navajo Camp. *Norris 55244* (UC).

Didymodon revolutus (Cardot) R. S. Williams
Central and eastern dry areas in the county, on soil in dry shrublands. Uncommon.
North of Rock Ranch, off Hwy 166 ca. 26 miles east of junction with Hwy 101. *Carter 1603*; West of intersection of Hwy 166 and eastern Los Padres NF boundary. *Carter 706*; Caliente Range, Saucito Springs. *Laeger 678A* (CAS) det. Toren, 2012.

Didymodon rigidulus Hedw.
Throughout the county on dry soils and sunny rock outcrops. Occasional.
Las Pilitas Rd, near junction with Pozo Rd. *Carter 970*; Rinconada Trailhead, east flank of Santa Lucia Mtns. *Carter 1030*; Caliente Range, at trailhead off Padrones Canyon Rd. *Carter 1548*; North of Rock Ranch, off Hwy 166 ca. 26 miles east of junction with Hwy 101. *Carter 1610*; See Canyon Rd., about one mile north of intersection with San Luis Bay Dr. *Carter 80*.

Didymodon tophaceus (Brid.) Lisa
Throughout the county, in seeps and along streams, especially associated with travertine deposits. Abundant.
Ragged Point. Waterfalls beneath giftshop between Hwy 1 and the ocean. *Carter 387*; Klau Mine Rd. near intersection with Adelaide Rd. *Carter 1290*; Moonstone Beach, along coast at Cambria. *Carter 1448*; Caliente Range, at Semper Spring. *Carter 862*; Hi Mountain Rd. east of Lopez Lake. *Carter 723*.

Didymodon vinealis (Brid.) R. H. Zander

Throughout the county, on disturbed soil of roadsides and trail banks. Abundant and nearly ubiquitous in coastal areas, less common inland.

Cuesta Ridge east of Hwy 101. *Carter* 124; Pozo Rd. east of Pozo Summit. *Carter* 227; Cerro San Luis Mtn., near San Luis Obispo *Carter* 258; Nipomo Mesa. *Carter* 264; Montana de Oro St. Park. *Carter* 270.

Eucladium verticillatum (With.) Bruch & Schimp.

Throughout the county, but especially in the Santa Lucias, in seeps and seasonally submerged in creeks with travertine deposits. Common.

Reservoir Canyon. *Carter* 282; Little Falls Trail in Lopez Canyon, about one half mile from trailhead. *Carter* 327; Ragged Point. Waterfalls beneath gift-shop between Hwy 1 and the ocean. *Carter* 386; Hi Mountain Rd, along Salt Creek. *Carter* 751; Saucito Springs, Carrizo Plain. *Laeger* 676 (CAS), det. Shevock & Toren 2014.

Gymnostomum aeruginosum Sm.

Known from a single collection north of Paso Robles, on rock outcrops in Blue Oak woodlands. Camp Roberts Military Reservation. *Norris* 100940 (UC).

Gymnostomum calcareum Nees & Hornsch.

Santa Lucias, on rock outcrops, especially shaded vertical surfaces.

San Simeon Creek Rd., at paved low water crossing. *Carter* 455;

Cypress Mtn. Rd. *Quercus agrifolia* woodland over serpentine substrate. *Carter* 1303; Hwy 166 at Clear Creek. *Norris* 80635 (UC); Upper Lopez Canyon Rd. *Carter* 307; Los Padres NF, along Hwy 166. *Carter* 1892.

Gymnostomum viridulum Brid.

Known only from the southern border of the county, on rock outcrops in dry woodlands.

Los Padres NF, along Hwy 166. *Carter* 704, 1882.

Hennediella stanfordensis (Steere) Blockeel

Throughout the county, on compacted and usually disturbed soils along trails and roadsides.

Irish Hills, off Perfumo Canyon Rd. *Carter* 9215; American Canyon Campground, Los Padres NF. *Norris* 80716 (UC); Hwy 166 at Clear Creek. *Norris* 80652 (UC); Camp San Luis Obispo Military Reservation. *Norris* 100993 (UC); Santa Margarita Lake. *Norris* 103596 (UC).

Microbryum davallianum (Sm.) R. H. Zander

Central and eastern areas in the county in dry grasslands. Uncommon, but likely overlooked.

Margarita Lake County Park. *Norris* 103588 (CAS); Hwy 166 at Clear Creek. *Norris* 80647 (UC).

Microbryum starckeanum (Hedw.) R. H. Zander

Central areas in the county, on soil among grasses in oak savannahs. Uncommon, but likely overlooked.

American Canyon Camp, Los Padres NF. *Norris* 80712 (UC); Los Padres NF, Red Hill Rd. *Carter* 10760; Lake Nacimiento, Rocky Canyon Camp. *Carter* 10780; Just north of Hwy 166 near eastern border of Los Padres NF. *Carter* 1424.

Pseudocrossidium crinitum (Schultz) R. H. Zander

Central and eastern, dry areas on soil in dry shrublands. Uncommon.

Temblor Range, along Crocker Canyon Rd. *Carter* 1629; Rock Ranch, Los Padres NF. *Carter* 1614.

Pseudocrossidium obtusulum (Lindb.) H. A. Crum & L. E. Anderson.

Throughout the county in dry grasslands, oak savannah understories and dry shrublands. Uncommon.

Caliente Range, at Semper Spring. Semidesert scrub. *Carter* 850; Los Padres NF, 1–2 mi along forest service road from intersection with Hwy 58. *Carter* 1698; Camp Roberts Military Reservation. *Norris* 100927 (UC); Los Padres NF, along Hwy 166. *Carter* 1426.

Stegonia hyalinotricha (Cardot & Thér.) R. H. Zander

Apparently uncommon in dry areas on soil among grasses. Likely overlooked elsewhere.

Camp Roberts Military Reservation. *Norris* 100927 (UC). Red Hill Rd. *Shevock* 53733 (CAS), det. Toren.

Syntrichia caninervis Mitt.

Caliente and Temblor Ranges, on soil in desert scrub. Uncommon.

Caliente Range, near Semper Spring. *Carter* 851; Caliente Range, off Padrones Canyon Rd. *Carter* 1561; Temblor Range, along Crocker Canyon Rd. *Carter* 1805.

Syntrichia laevipila Brid.

Known from ornamental tree trunks in San Luis Obispo and a Blue Oak woodland north of Paso Robles. Apparently uncommon.

City of San Luis Obispo, Downtown area. *Carter* 549; Chimney Rock Rd., west of Paso Robles. *Carter* 9338.

Syntrichia montana Nees

Known only from a serpentine outcrop in Reservoir Canyon, but likely overlooked due to similarity with other *Syntrichia* species.

Reservoir Canyon. *Carter* 10813.

Syntrichia pagorum (Milde) Amann

Known from a single collection north of San Luis Obispo from tree trunks in blue oak woodland. Likely more widespread. This species is lumped with *S. laevipila* by some authors, but is recognized as distinct here following Norris and Shevock (2004a, 2004b).

Camp San Luis Obispo. *Norris* 100876 (UC).

Syntrichia papillosa (Wilson) Jur.

In and around San Luis Obispo, on tree trunks. Uncommon.

California Polytechnic State University. *Carter 1163*; North shore of Chorro Reservoir, Camp San Luis Obispo, *Norris 100974* (UC).

Syntrichia papillosissima (Copp.) Loeske

Known from a single collection on soil in the Caliente Range.

Caliente Range, on north facing hillside above trailhead off Padrones Canyon Rd. *Carter 1563*.

Syntrichia princeps (DeNot.) Mitt.

Throughout the county, on tree trunks, rock outcrops and soil. Abundant.

Little Falls Trail in Lopez Canyon, about one half mile from trailhead. *Carter 330*; Hi Mountain Rd, east of Lopez Lake. *Carter 743*; Caliente Range, at Semper Spring. *Carter 865*; Hwy 166 about one mile east of Rock Ranch. *Carter 1897*; Oak View Rd. off Hwy 46 west of Paso Robles. *Carter 1278*.

Syntrichia ruralis (Hedw.) F. Weber & D. Mohr

Widespread throughout the county, on soil and rock outcrops, less commonly on trees. Abundant.

Nipomo Mesa. *Carter 263*; Hwy 41, about 12 miles east of Atascadero. *Carter 557*; Hi Mountain Rd, east of Lopez Lake. *Carter 747*; Caliente Range, near Semper Spring. Semidesert scrub. *Carter 852*; Upper Pennington Creek. *Carter 909*.

Syntrichia sucrosa Kellman

Central and eastern areas of the county, juniper woodlands and desert scrub. Uncommon.

Hwy 58. Juniper woodland with *Eriogonum fasciculatum*. *Carter 72*; Caliente Range, on Padrones Canyon Rd between Soda Lake Rd and Caliente Ridge. *Carter 1537*.

Timmiella anomala (Bruch & Schimp.) Limpr.

Coastal areas and Santa Lucias, on soil among grasses in woodlands and coastal scrub. Common near the coast, occasional inland.

Near intersection of See Canyon Rd. and Pippin Lane. *Carter 93*; Pozo Rd. beyond where pavement ends. *Carter 223*; Cerro San Luis Mtn., near San Luis Obispo *Carter 257*; Hi Mountain Rd., east of Lopez Lake. *Carter 737*; Cuesta Ridge, west of Cuesta Pass. *Carter 884*.

Timmiella crassinervis (Hampe) L. F. Koch

Santa Lucias, on soil among grasses in woodlands and coastal scrub. Common.

Ragged Point. Waterfalls beneath giftshop between Hwy 1 and the ocean. *Carter 388*; Hi Mountain Rd, east of Lopez Lake. *Carter 746*; Santa Margarita Lake along trail on southwest side of the lake. *Carter 1040*; Hwy 46 near York Mountain Rd. *Carter 10474*; Lake Nacimiento, Rocky Canyon Camp-ground. *Carter 10785*.

Tortula acaulon (With.) R. H. Zander

[*Phascum cuspidatum* Hedw.]

Coastal areas and northern Santa Lucias. On soil among grasses in grasslands and openings in coastal scrub and woodlands. Occasional.

Camp Roberts Military Reservation. *Norris 100933* (UC); Santa Margarita Lake. *Norris 103611* (UC); Los Padres NF, Red Hill Rd. *Carter 10755*; Cerro San Luis. *Carter 10735*; Lake Nacimiento. *Carter 10781*.

Tortula atrovirens (Sm.) Lindb.

Throughout the county on soil in grasslands and openings in shrublands. Often on serpentine. Common near the coast, occasional inland.

Chimeneas Ranch in the mountains southwest of Soda Lake. *Carter 1107*; California Polytechnic State University campus. On serpentine ridge above the California Polytechnic State University P. *Carter 1179*; Stagecoach Rd, just below Cuesta Pass. *Carter 1195*; South Hills, San Luis Obispo County Green-space. Southern San Luis Obispo city. *Carter 1442*; North of Rock Ranch, off Hwy 166 ca. 26 miles east of junction with Hwy 101. *Carter 1618*.

Tortula bolanderi (Lesq.) M. Howe

Coastal and central areas, on soil among grasses in woodlands. Known from two collections but likely more widespread.

Queen Bee Camp, Los Padres NF. *Norris 55177* (MO) det. Zander; Camp San Luis Obispo. *Norris 100882* (UC).

Tortula brevipes (Lesq.) Broth.

Widespread throughout the county on soil among grasses in grasslands and in shrublands and woodlands. Occasional near the coast and common in the interior.

Highway 41 between Shandon and Creston. *Carter 554*; Vineyard Rd, west of Paso Robles. *Carter 1282*; Caliente Range, off Padrones Canyon Rd. *Carter 1569*; Lake Nacimiento, Rocky Canyon Camp. *Carter 10782*; Los Padres NF, Red Hill Rd. *Carter 10758*.

Tortula californica E. B. Bartram

Coastal areas, on soil in grasslands and coastal scrub. Occasional.

Bob Jones Bike Trail, near Avila. *Carter 606*; Diablo Canyon nuclear power facility (PG&E) property. *Carter 1224*; Cerro San Luis. *Carter 10733*.

Tortula guepinii (Bruch & Schimp.) Broth.

Throughout the county on soils in shrublands and grasslands. Common in the interior, occasional near the coast.

Caliente Range, near Semper Spring. *Carter 853*.; Carrizo Plain north of Soda Lake. *D.J. Keil 30338*; Temblor Range, along Hwy 58. *Carter 1794a*; Cerro San Luis. *Carter 10724*.

Tortula inermis Brid.

Known from a single collection in desert scrub from the Caliente Range. This is one of very few specimens

from the Coast Ranges of this species that is common in California deserts.

Caliente Range, on north facing hillside above trailhead off Padrones Canyon Rd. *Carter 1562*.

***Tortula muralis* Hedw.**

Coastal areas, in and around anthropogenic environments, especially on concrete, brick mortar and other calcareous substrates. Occasional.

See Canyon Rd, about 1 mile north of intersection with San Luis Bay Dr. *Carter 78*; California Polytechnic State University campus. *Carter, 1178*.

***Tortula plinthobia* (Sull. & Lesq.) Broth.**

Throughout the county on soils in shrublands and grasslands. Common in the interior, occasional near the coast.

Hwy 58, near of junction with Hwy 229. *Carter 67*; Highway 41 between Shandon and Creston. *Carter 555*; Temblor Range, along Crocker Canyon Rd. *Carter 1625*; Camp Roberts. *Norris 100881* (UC); Los Padres NF, Red Hill Rd. *Carter 10759*.

***Tortula protobryoides* R. H. Zander**

This species is known in the county only from a historical collection, but it is likely to be rediscovered in coastal scrub or grassy areas around San Luis Obispo and Arroyo Grande. The historical specimen was widely distributed (as *Phascum bryoides* Dicks.) as Holzinger's *Musci Acrocarpi Boreali-Americani* number 328.

Arroyo Grande. *O.D. Allen s.n. 5 Mar 1889* (F, DUKE)

***Weissia controversa* Hedw.**

Santa Lucias and coastal areas, inland to Santa Margarita Lake. On soil banks and among grasses in grasslands, woodlands and shrublands. Common.

Santa Margarita Lake, *Carter 1066*; West Cuesta Ridge. *Carter 880*; Diablo Canyon Property. *Carter 1225*; Cypress Mountain Rd. *Carter 1305*; Cerro San Luis. *Carter 10725*.

***Weissia ligulifolia* (E. B. Bartram) Grout**

Known from a single population along Red Hill Rd in soil crusts.

Los Padres NF, Red Hill Rd. *Carter 10761*.

LIVERWORTS

Aneuraceae

***Riccardia chamedryfolia* (With.) Grolle**

Along the immediate coast, grassy banks in humid areas. Known from a single collection.

Montana de Oro State Park, Coon Creek trail. *Doyle 9480* (UC).

***Riccardia latifrons* (Lindb.) Lindb.**

Along the immediate coast, grassy banks in humid areas. Known from a single collection.

San Simeon St. Park. *Carter 1816*.

Aytoniaceae

***Asterella bolanderi* (Austin) Underw.**

Santa Lucias and coastal areas, less commonly in the interior, on soil in grassy areas. Uncommon.

Suey Canyon Rd, several miles north of Hwy 166. *Carter 702*; Park Hill Rd, south of junction with Las Pilitas Rd. *Carter 981*; Hwy 166 at Clear Creek. *Norris 80605* (UC), det. Doyle 2006; Adelaide Rd, about 3.2 mi east of junction with Cypress Mountain Rd. *Doyle 432* (UC); 0.5 mi west of Cuesta College. *Norris 101012* (UC).

***Asterella californica* (Hampe ex Austin) Underw.**

Throughout the county, but more common in coastal areas and the Santa Lucias. On soil banks in grasslands and grassy openings in shrublands and woodlands. Abundant.

Pozo Rd. east of summit. *Carter 239*; North facing serpentine outcrop along Perfumo Canyon Rd. *Carter 807*; Ridge trail between Avila Beach Drive and coastline, east of the town of Avila. *Carter 1268*; Camp Roberts Military Reservation. *Norris 100892* (UC), det. Doyle 2006; Lynch Canyon Rd about 3 mi from Interlake Rd. south of San Antonio Reservoir. *Norris 85154*, det. Doyle 2006 (UC).

***Asterella palmeri* (Austin) Underw.**

Santa Lucias, soil banks in grasslands, shrublands and woodlands. Uncommon.

Agua Escondido Springs Rd, west side of Garcia Mountains. *Doyle 2245* (UC); Lopez Canyon Rd about 2.7 mi east of junction with Huasna Rd. *Doyle 2276* (UC); Huasna Rd, about 11.9 mi east of junction with Arroyo Grande Rd. *Doyle 2245* (UC); Lake Nacimiento, Rocky Canyon Campground. *Carter 10783*.

***Cryptomitrium tenerum* (Hooker) Austin ex Underw.**

Santa Lucias and coastal areas, grassy slopes in grasslands and coastal scrub. Uncommon.

Poly Canyon. *Carter 10307*; Huasna Rd about 25.5 mi southeast of junction with Arroyo Grande Rd. *Doyle 2257* (UC).

Cephaloziellaceae

Cephaloziella divaricata* (Sm.) Schiffn. var. *divaricata

Santa Lucias and coastal areas, on bare soil in soil crusts and other compacted, undisturbed, foggy sites. Occasional.

Santa Margarita-Pozo Rd, between Rinconada mine and Pozo. *Doyle 2290* (UC); Santa Margarita Lake. *Carter 1055*; Diablo Canyon Property, in pine forest. *Carter 420*; Cuesta Ridge, east of Hwy 101. *Carter 10810*; Lake Nacimiento, Rocky Canyon Campground. *Carter 10777*.

***Cephaloziella turneri* (Hook.) Müll. Frib.**

Northern Santa Lucias, mesic soil banks. Uncommon.

Adalaide Rd, ca. 1.9 mi east of Cypress Mtn. Rd. *Doyle* 425 (UC); Cypress Mountain Rd. *Carter* 1333; Hwy 46 near York Mountain Rd. *Carter* 10473.

Cleveaceae

Athalamia hyalina (Sommerf.) S. Hatt.
Known from a single collection in the northern Santa Lucias.
Near junction of York Mountain Rd with Shadow Canyon Rd. *Doyle* 413 (UC).

Fossombroniaceae

Fossombronia longiseta (Austin) Austin
Central and western areas of the county, on soil among grasses in grasslands shrublands and woodlands. Common.
Santa Margarita Lake County Park, *Norris* 103597 (UC); Camp San Luis Obispo Military Reservation east of Cerro Romaldo. *Norris* 101002 (UC); Santa Rita Rd between Cayucos and Templeton, east of ridge. *Doyle* 5719 (UC); Cerro San Luis. *Carter* 10734; Lake Nacimiento, Rocky Canyon Campground. *Carter* 10791.

Fossombronia pusilla (L.) Nees
Central and western areas of the county, on soil among grasses in grasslands shrublands and woodlands. Occasional.
See Canyon Rd near Avila beach and Perfumo Canyon Rd. *Doyle* 5746 (UC); Los Padres NF, Red Hill Rd. *Carter* 10746.

Frullaniaceae

Frullania bolanderi Austin
Coastal areas and northern Santa Lucias, on tree trunks in foggy areas. Occasional.
Irish Hills, off Perfumo Canyon Rd. *Carter* 9210; See Canyon Rd. *Carter* 76; Poly Canyon. *Carter* 10317; Santa Rita Rd., between Templeton and Cayucos. *Carter* 10480.

Frullania catalinae A. Evans
San Luis Range and vicinity of San Luis Obispo, on tree trunks or less commonly on boulders. Occasional.
Diablo Canyon nuclear power facility (PG&E) property. *Carter* 1215; South Hills, San Luis Obispo County Greenspace. *Carter* 1446; Irish Hills, off Perfumo Canyon Rd. *Carter* 9213; Poly Canyon, near the quarry. *Carter* 1092; Cerro San Luis. *Carter* 10740.

Geocalycaceae

Lophocolea bidentata (L.) Dumort.
Restricted to Bishop Pine forest above Coon Creek. On soil over leaf litter. This species, common along the northern coast of California, is known only from Bishop Pine forests in southern California at this station and on the Channel Islands (Carter 2015).

Diablo Canyon nuclear power facility (PG&E) property. *Carter* 1347.

Gymnomitriaceae

Marsupella bolanderi (Austin) Underw.
Restricted to Monterey and Bishop Pine forests, on bare soil.
Ridge above and to the west of Coon Creek. *Carter* 419b; Monterey Pine forest at Fiscalini Ranch Reserve. *Carter* 10824.

Lunulariaceae

Lunularia cruciata (L.) Dumort. ex Lindb.
Known only from Arroyo Grande, this common introduced species may be more widespread along streambanks in mesic areas. However, it is large and not easily overlooked, suggesting at least that it is not at all common in the county.
Arroyo Grande Creek in historic downtown Arroyo Grande. *Carter* 725.

Marchantiaceae

Marchantia polymorpha L.
Known from a single collection along Coon Creek trail. Although native to California, this species is not typically found in coastal habitats in the region and this station may be the result of a recent introduction.
Montana de Oro State Park, Coon Creek trail. *Doyle* 9483 (UC).

Porellaceae

Porella bolanderi (Austin) Pearson
Coastal areas, extending through the Santa Lucias to the area around Santa Margarita Lake. On shady rock outcrops and tree bases, especially along creeks. Abundant.
Hi Mountain Rd at northernmost crossing of Trout Creek. In seasonal creek bed. *Carter* 768; Santa Margarita Lake, southern shore of lake. *Carter* 1068; Stagecoach Rd, just below Cuesta Pass. *Carter* 1198; Cypress Mtn. Rd. *Carter* 1321; Upper Pennington Creek. *Carter* 907.

Porella cordaeana (Huebener) Moore
Coastal areas and northern Santa Lucias. On rock outcrops and tree bases in shaded canyons. Uncommon.
California Polytechnic State University, Poly Canyon. *Carter* 10319; Montana de Oro. *Norris* 6817, (UC); Camp San Luis Obispo Military Reservation. *Norris* 100971 (UC); San Simeon Creek Rd. *Carter* 444; Santa Rita Rd, between Templeton and Cayucos. *Carter* 10478.

Ricciaceae

Riccia californica Austin

Known from a single collection in grasslands from north of San Luis Obispo.

El Chorro Regional Park. *Doyle 7230* (UC).

***Riccia campbelliana* M. Howe**

Known from two collections in soil crusts in grasslands and shrublands.

Montana de Oro. *Doyle 11343* (COLO); Los Padres NF, Red Hill Rd. *Carter 10744*.

***Riccia cavernosa* Hoffm.**

Known from a single collection in the southwest corner of the county.

Huasna Rd, 25.5 mi southeast of junction with Arroyo Grande Rd. *Doyle 2667* (UC).

***Riccia frostii* Austin**

Known from two collections in open oak woodlands from the central and northern areas of the county.

Margin of Santa Margarita Lake. *Doyle 7052* (UC); Margin of Lake Nacimiento. *Doyle 7048* (UC).

***Riccia glauca* L.**

Known from two collections, with quite different habitats- one in open oak woodlands, the other in Monterey Pine Forest.

Camp Roberts Military Reservation. *Norris 100916* (UC); Fiscalini Ranch Reserve. *Carter 10826*.

***Riccia lamellosa* Raddi**

Known from two collections from the northern Santa Lucias and near the coast.

San Simeon Creek Rd, east of Hwy 1. *Doyle 5704* (UC); Cerro San Luis. *Carter 10730*.

***Riccia nigrella* DC.**

Coastal and interior regions, on soil in crusts and in openings in shrublands and woodlands. Common.

Camp Roberts Military Reservation at Twin Bridges. *Norris 100952* (UC); Huasna Rd about 11.9 mi southeast of junction with Arroyo Grande Rd. *Doyle 2243* (UC); Navajo Campground Rd, La Panza Range, about 0.1 mi southwest of junction with Hwy 58. *Doyle 2311* (UC); Cerro San Luis. *Carter 10729*; Lake Nacimiento. Rocky Canyon Campground. *Carter 10792*; Los Padres NF, Red Hill Rd. *Carter 10748*.

***Riccia sorocarpa* Bisch.**

Throughout the county in soil crusts and openings in shrublands and woodlands. Common near the coast, occasional in the interior.

Camp Roberts Military Reservation. *Norris 100929* (UC), det. *Doyle 2004*; Hwy 166 at Clear Creek. *Norris 80661* (UC), det. *Doyle 2006*; El Chorro Regional Park. *Doyle 7231* (UC); Lopez Canyon Rd, about 0.8 mi north of junction with Huasna Rd. *Doyle 2271* (UC); Los Padres NF, Red Hill Rd. *Carter 10747*.

***Riccia trichocarpa* M. Howe**

Throughout the county in soil crusts and openings in shrublands and woodlands. Common in the central

area of the county, occasional near the coast and in the east.

Hwy 58, Los Padres NF. *Doyle 2307* (SIU); Hwy 166 at Clear Creek. *Norris 80625* (UC); Camp Roberts Military Reservation. *Norris 100930* (UC); Los Padres NF, Red Hill Rd. *Carter 10743*.

Sphaerocarpaceae

***Sphaerocarpos michelii* Bellardi**

Known from a single collection on soil in blue oak woodland along Red Hill Rd.

Red Hill Rd. *Shevock 53735* (CAS).

***Sphaerocarpos texanus* Austin**

Throughout the county in soil crusts and on compacted soil of roadsides and trails. Common.

Hwy 166 at Clear Creek. *Norris 80660* (UC); Santa Margarita Lake County Park. *Norris 103610* (UC); Montana de Oro Rd, Quarry Trail. *Doyle 5432* (UC); San Simeon Creek Rd. *Doyle 5700* (UC); Temblor Range. Bitterwater-Palo Prieto Pass Rd. *Doyle 7098* (UC).

Targioniaceae

***Targionia hypophylla* L.**

Throughout the county on shaded to open soil banks. Common.

California Polytechnic State University, Poly Canyon. *Carter 1081*; Stagecoach Rd, just below Cuesta Pass. Open *Quercus agrifolia* woodland on east facing slope. *Carter 1194*; University of California's Rancho Marino Reserve south of Cambria. *Carter 1491*; Dirt road connecting Pozo Rd with Pine Mountain. *Carter 934*; Hwy 166 at Clear Creek. *Norris 80604* (UC).

HORNWORTS

Anthocerotaceae

***Anthoceros agrestis* Paton**

Known from two collections, from the northern Santa Lucias and near the coast.

Santa Rita Rd near Old Creek Rd. *Doyle 9478* (UC); Montana de Oro. *Doyle 9478* (UNAF).

***Anthoceros fusiformis* Mont.**

Northern Santa Lucias and near the coast, extending inland to the Santa Margarita Lake region. Grasslands and coastal scrub. Occasional.

El Chorro Regional Park. *Doyle 7224* (UC); Santa Margarita. *Goldman 3303* (FH); Eight miles west of Templeton. *Rose 36240* (COLO); Montana de Oro. Reservoir Flats Trail. *Doyle 5728* (UC); Pozo Rd, about 3 mi east of junction with Santa Margarita Lake Rd. *Doyle 9475* (UC).

Notothyladaceae

***Phaeoceros pearsonii* (M. Howe) Prosk.**

Northern Santa Lucias and coastal areas, grasslands and along trails in coastal scrub and woodlands. Abundant.

Lynch Canyon Rd about 2 mi from Interlake Rd. *Norris 85148* (UC), det. Doyle 2005; Pozo Rd about 2.7 mi east of junction with Santa Margarita Lake Rd. *Doyle 9474* (UC); See Canyon Rd between Sycamore Mineral Springs and San Luis Obispo. *Doyle 5745* (UC); Santa Rita Rd between Cayucos and Templeton, east of ridge. *Doyle 5726* (UC); Cuesta Ridge Rd, about 0.6 mi west of junction with Hwy 101. *Doyle 5744* (UC).

Phaeoceros proskaueri Stotler, Crandall-Stotl. & W. T. Doyle
Known from a single collection in the northern Santa Lucias, but likely more common.
Chimney Rock Rd about 4.4. mi northeast of Klau Mine Rd. *Doyle 8210* (UC).

Phymatoceros bulbiculosus (Brot.) Stotler, W. T. Doyle & Crandall-Stotl.
Northern Santa Lucias and coastal areas, in grasslands and coastal scrub. Occasional.
Montana de Oro Rd, Quarry Trail. *Doyle 11345* (UC); Lynch Canyon Rd near San Antonio Reservoir. *Norris 85167* (UC) det. Doyle 2006; El Chorro Regional Park. *Doyle 9471* (UC).

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A BRYOPHYTE INVENTORY OF MOUNT DIABLO, CONTRA COSTA COUNTY, CALIFORNIA

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ABSTRACT

Mount Diablo in Contra Costa County is a notable peak in California's central Coast Ranges, well known for its biodiversity. To date, no accounts of the bryophytes on this mountain have been published. We present a catalogue of the mosses, liverworts, and hornworts known to occur on Mount Diablo. We base this on collections made by us and augmented by specimens from other collectors that are housed in North American herbaria. We collected extensively on the mountain from 2014 to 2020. Online databases were searched to locate specimens from Mount Diablo. These were located predominantly at the University of California Berkeley (UC) or California Academy of Sciences (CAS). Specimens were examined at these herbaria to confirm their presence and to confirm identifications as needed. We list 160 bryophyte taxa on the mountain, including 137 mosses, 20 liverworts, and three hornworts. Forty families and 75 genera are represented, with Pottiaceae having the most species (39). We list separately 22 taxa that we consider unconfirmed on Mount Diablo because they are represented only by herbarium specimens that we could not locate, or for other reasons as given. Our own collections added 19 bryophyte species (17 mosses and two liverworts) since 2014. We did not find 41 of the confirmed taxa reported on Mount Diablo by others. Thirty-three taxa have so far been collected only once on the mountain. These numbers imply that additional taxa occur there and have not yet been found. We discuss the distribution of taxa within different parts of the mountain, and the Mount Diablo bryophyte flora is briefly compared with that of neighboring regions and of California as a whole.

Key Words: biodiversity, bryophytes, California, Coast Ranges, flora, Mount Diablo.

Documenting the natural distribution of plants is essential for understanding their biology, identifying threatened species, and guiding conservation efforts. While many efforts to date have focused on studying the distribution of vascular plants, bryophyte surveys have received much less attention. The bryophyte survey reported here, involving Mount Diablo, California, adds to expanding documentation of bryophytes in the State. It augments a better and more recent knowledge of their biodiversity and the role they play in biological communities. Other notable regional bryophyte inventories in California include those of the bryophytes of Marin County (Yurky 1995), the mosses for the City and County of San Francisco (Shevock and Toren 2001), the mosses of Santa Cruz County (Kellman 2003), the mosses of Plumas National Forest (Dillingham 2015), the mosses of Lake County (Toren 2015), the mosses of the San Francisco Bay Area (Whittemore 2020a), bryophytes of San Luis Obispo County (Carter 2021, this volume) and mosses of Napa County (Rae 2021,

this volume). These regional bryophyte accounts complement several for the State as a whole, including moss lists by Koch (1951), Norris and Shevock (2004a), a geographical overview of Californian mosses by Shevock (2013), and catalogues of liverworts and hornworts by Doyle and Stotler (2006) and Whittemore (2020b).

With a summit elevation of 3849 ft, Mount Diablo is a notable peak in California's central Coast Ranges, well known for its biodiversity, which has been intensively studied (see for example Baltzo 1970, 1989; Bowerman 1944; Ertter and Bowerman 2002; Vaughan 2004; Wallace 2007). Plants and wildlife on the mountain are well documented on the software app iNaturalist (<https://www.inaturalist.org>). The rich vascular plant flora contains more than 900 taxa, including two angiosperm species that are strictly endemic to the mountain and several others that have very limited distribution elsewhere (Bowerman 1944; Ertter and Bowerman 2002). Lichens have also been studied on Mount Diablo (Baltzo 1970) and a checklist has been published (Baltzo 1989). However, little published information about bryophytes on the mountain is available. This study aims

[†] Deceased Dec 23rd 2016.

to fill this void by providing a comprehensive inventory of bryophytes known from Mount Diablo. In compiling this, the authors' collections, spanning the years 2014 to 2021, have been used to augment those previously reported for the area and housed in various herbaria within the United States.

A map of Mount Diablo is shown in Fig. 1. Situated within Contra Costa County, its summit lies approximately 30 miles due east of San Francisco. The mountain comprises the 20,000-acre Mount Diablo State Park and an additional 90,000 acres of surrounding privately owned and preserved lands. Protected land on the west side of the mountain has been significantly augmented over the past 50 years through the additions of Diablo Foothills Regional Park, Shell Ridge Open Space and Lime Ridge Open Space. The region considered for this survey is shown in Fig. 1 and is delimited by the northern boundary of Mount Diablo State Park and Marsh Creek Road, Morgan Territory Road to the east, the canyons Emmons, Dan Cook, Sycamore and Riggs to the south, and Ignacio Valley to the west.

The climate, geology, soils, and vegetation of Mount Diablo have been described in detail by Bowerman (1944) and Ertter and Bowerman (2002). Drawing on these sources and other information, these features are summarized below.

CLIMATE

The climate of Mount Diablo is classed as Mediterranean, characterized by cool wet winters and hot dry summers. The National Weather Service maintains a station at Diablo Junction at an elevation of 2160 feet. Average maximum temperatures there reach 86°F in July with average minimum temperatures of 39°F in January (Western Regional Climate Center 2021). Limited daily weather information at the summit itself is available at MesoWest, University of Utah (2021). Summit temperatures probably approximate those at the Lick Observatory on the summit of Mount Hamilton, 40 miles to the south, which is 400 feet higher. There, an average maximum temperature of 78°F occurs in July, with average minimum of 37°F in January (Western Regional Climate Center 2021).

Rain falls predominantly between November and April, although a few showers can occur during the summer months. Average annual rainfall for the Diablo Junction station is 24 inches; Mount Diablo summit rainfall is probably slightly higher. Snow occurs sporadically on the summit. In some years there is no snowfall, but in other years depths of up to 30 inches have been recorded. Average snowfall for the summit of Mount Hamilton amounts to 18 inches. Snow is rare on these mountains below 2000 feet.

Fog and low cloud is encountered on the mountain's upper reaches and summit during fall, winter, and spring storms. Less is found during the region's hottest months of July and August. However, evidence of summertime fog drip has occasionally

been observed, where moisture is found to accumulate under trees and shrubs. One example was found during this survey at around 1600 feet elevation on the southeast flank of the mountain near Curry Point.

GEOLOGY

The geology of Mount Diablo was reviewed by Bowerman (1944), prior to the understanding of plate tectonics that occurred in the 1960s. A revised treatment that we draw from here was presented by Sloan (2002). Other accounts include an article by Wallace (2007). Mount Diablo is considered a relatively young mountain that formed around 1-2 million years ago. How it became uplifted is still a topic of debate (Wallace 2007). As a result of compression along several thrust faults in the area, it is believed that the Franciscan rocks that form the upper part of the mountain pierced through the overlying sedimentary rocks, which were pushed aside and then eroded away, leaving remnants on some flanks of the mountain.

A diverse range of rock types constitute Mount Diablo. Two principal assemblages are recognized (Sloan 2002). A core area approximately five miles in diameter, exposed at the upper levels of the mountain and summit, is composed of late Jurassic to Cretaceous (190 to 65 Mya) basalts, cherts and lesser amounts of graywacke sandstones and serpentinite (the Franciscan Complex and Coast Range Ophiolite). These are believed to have been uplifted through movements associated with plate tectonic activity (Wallace 2007). A prominent band of serpentine runs east-west across the north side of the mountain about halfway up, passing through Murchio Gap, then just north of Deer Flat and west to Long Ridge. This band supports a visibly different vegetation and provides habitat for some of the rarest flowering plants on the mountain, including the distinctive endemic *Cordylanthus nidularius* J.T.Howell. Unaltered marine sedimentary rocks, chiefly siliceous and clay shales together with greywacke sandstones (the Great Valley Group) surround the Diablo core area at lower elevations. These are more recent than the higher elevation rocks and date from Cretaceous times (145 to 65 Mya) on the east and southeast sides of the mountain, while sandstones and shales from Eocene to Pleistocene times (50 to two Mya) occur on the west and southwest sides. Detailed soil maps are available from California State Parks (2021).

MAJOR PLANT COMMUNITIES

A detailed account of the vegetation of Mount Diablo is given by Bowerman (1944) and Ertter and Bowerman (2002). To summarize, open mixed hardwood woodlands interspersed with savannah grasslands form the predominant vegetation communities on Diablo (see Fig. 2). At the summit and upper elevations (above 3250 feet) on the northerly exposed slopes, *Quercus chrysolepis* Liebm. is locally

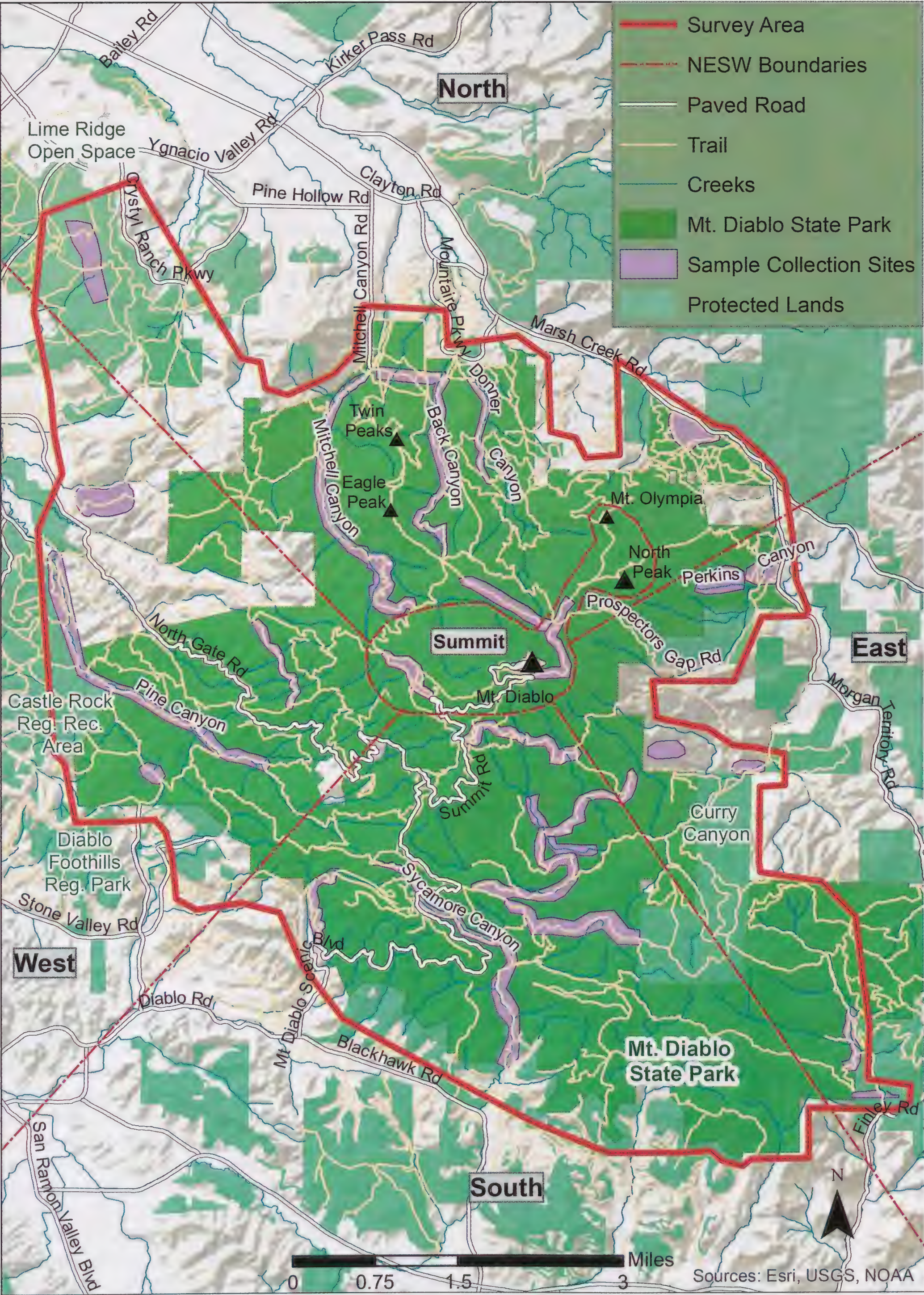


FIG. 1. A map of Mount Diablo showing the boundary of our study area and the routes walked during our fieldwork on the mountain. Also shown are the boundaries we chose for five regions we used for analysis of relative diversity of bryophytes on different parts of Mount Diablo, see text. Map by Roxana Lucero and DH.



FIG. 2. Habitats on Mount Diablo. A view towards the summit (in mist) from Curry Canyon to the southeast. Oak woodland and grassland dominate the lower slopes, with chaparral above that and rocky country at higher elevations. Photo by JCG.

dominant. Associates include other *Quercus* L. species (*Q. agrifolia* Née, *Q. wislizeni* DC.) and *Umbellularia californica* Nutt., with understory shrubs *Holodiscus discolor* (Pursh) Maxim, *Heteromeles arbutifolia* (Lindley) Roemer, and *Toxicodendron diversilobum* (Torrey & A.Gray) Greene. At lower elevations on the north-facing slopes, an association of *Quercus agrifolia* and *Aesculus californica* (Spach) Nutt., occurs. The association is also found along canyon bottoms on the southern flank of the mountain. Understory shrubs again include *Holodiscus discolor*, *Heteromeles arbutifolia*, and *Toxicodendron diversilobum*, together with *Frangula californica* (Eschsch.) A.Gray. *Quercus douglasii* Hook. & Arn., associated with *Pinus sabiniana* Dougl., at upper elevations, is an important species on the southern exposed dry, rolling hillsides.

Riparian communities are especially well represented on the north-facing sides of the mountain, along permanent creeks in Mitchell Canyon, Back Canyon and Donner Canyon. Here *Alnus-Platanus* associations can be dominant. Where water is reliable, *Alnus rhombifolia* Nutt., *Platanus racemosa* Nutt., and *Populus fremontii* Wats., characteristically

occur. Commonly encountered understory shrubs include *Frangula californica* and *Toxicodendron diversilobum*. Lesser creeks are on the south side of the mountain (Sycamore, Dan Cook); generally, these are seasonal in nature especially in the upper reaches. Mountain Spring Creek runs year-round.

Ponds, springs, and seeps provide diverse habitats for bryophytes. Most of these are located on the southern and eastern exposed slopes of the mountain, the majority between 1000 feet and 2000 feet. Several sulfur springs and seeps are located on the eastern and southerly aspects of the mountain; these are strictly seasonal and show reliable flows only after heavier rains. While summer fog is not as common as on coastal hills of adjacent counties, evidence of fog is found on southeasterly slopes, for example around 1500 feet elevation at Curry Point in Mount Diablo State Park.

Grasslands occupy the mountain from base to summit, though above 3500 feet, where the terrain becomes increasingly rocky, they become progressively more poorly represented. Chaparral is a major plant community on the mountain in two principal locations. One location at the 1200–1800 foot level running NW/SE occupies ridges of the Black Hills on the southern face, while the other is found on upper reaches of the northern slopes above 2000 feet and around the summit. *Arctostaphylos* Adans. species and *Cercocarpus betuloides* Torrey & A.Gray in association with *Adenostoma fasciculatum* Hook. & Arn., *Quercus durata* Jepson, and other oaks compose the principal communities.

COLLECTION HISTORY

The early history of bryology in California has been described in detail by Thiers and Emory (1992), who report that the first known collections were by A. Menzies in 1793. On Mount Diablo, bryophytes have been collected for more than a 150 years, with by far the most collections occurring within the last 20 years. The earliest collections known to us were those of H.N. Bolander in the 1860s. However, these specimens have little information as to the year or the location on the mountain where they were obtained, and in some cases may have been collected elsewhere and mistakenly assigned to Mount Diablo later. In 1896, M.A. Howe, a cryptogamic botanist at the University of California, Berkeley, made significant collections on the mountain, many of which are housed at the California Academy of Sciences (CAS) and at the New York Botanical Garden (NY), where he became director. Among noted botanists in the first half of the twentieth century whose Mount Diablo collections included bryophytes were Alice Eastwood (1923), Annetta Carter (1933) and John Thomas Howell (1930s to 1950s). Leo F. Koch collected on the mountain in 1947–50. In the latter half of the 20th century, collectors included F.J. Hermann (1962), W.B. Schofield (1962–81) and W.T. Doyle (1997).

Collecting increased dramatically from the year 2000 onwards with the work of D.H. Norris and J.R. Shevock. Both these collectors added specimens from many parts of the mountain that reside in the University of California, Berkeley (UC) and California Academy of Sciences (CAS) herbaria. Further collections were contributed by B. Ertter, J. Game, and A. Whittemore. In 2014, following suggestions by B. Tan, the authors of this report began collecting activities that are ongoing.

METHODS

We used two approaches in parallel to compile the inventory of Mount Diablo Bryophytes listed in the Catalogue below.

First, we employed online databases and direct herbarium searches to locate existing specimens from the mountain. We made online searches of all US herbaria that are included (as of 2020) in the Consortium of North America Bryophyte Herbaria to establish the extent of existing collections. We also physically searched the herbaria at CAS and UC, where most Mount Diablo specimens are deposited. We compiled a database listing specimens found online and/or physically in the herbaria with details of collector, habitat, location, date collected, herbarium where housed, and the determiner.

Second, we undertook fieldwork on the mountain to collect new specimens, visiting many areas as shown in Fig. 1. We chose collection sites to maximize representation of the different aspects, elevations, microclimates, and diversity of habitats that occur on Mount Diablo. Visits were made at all times of year, with an emphasis on winter and spring, especially for those areas where ephemeral species were a focus. We identified these collections, sometimes with expert help from specialists, details were entered into our database, and specimens were deposited at either the CAS or UC herbaria.

To compile the catalogue, we cited all known specimens from our database for each taxon where there were five or fewer collections. Where more than five existed, we cited five representatives, choosing specimens from different locations on the mountain, where available, to reflect in part the distribution of each taxon there.

For each pre-existing specimen cited in the catalogue from the CAS or UC herbarium, we checked for its current physical presence in the relevant herbarium and assessed the reliability of the identification. In some cases, for unknown reasons, we were not able to locate specimens listed online as being present at CAS or UC, despite searching the original folders as well as those of related taxa to which the specimens might have been re-assigned. In these cases, this is stated in the catalogue. We re-identified those specimens where we felt that ambiguity existed, with help from specialists when necessary. Specimens were identified using a variety of bryophyte keys and descriptions, including those

in Lawton (1971), Flowers (1973), Crum and Anderson (1981), Schofield (2002), Norris and Shevock (2004b), Doyle and Stotler (2006), Malcolm et al. (2009), as well as *Flora of North America* Vols. 27 (Flora North America Editorial Committee 2007), 28 (Flora North America Editorial Committee 2014), and 29 (Flora North America Editorial Committee in prep).

RESULTS AND DISCUSSION

Our catalogue reveals that 160 bryophyte taxa, including 137 mosses, 20 liverworts and three hornworts, are confirmed from Mount Diablo. Table 1 shows that 40 bryophyte families and 75 genera are represented, with Pottiaceae having by far the most species (39) followed by Bryaceae (18), Orthotrichaceae (13), and Grimmiaceae (12). There are 11 species of *Grimmia* Hedw., on the mountain, probably reflecting the amount of rocky and rather dry habitat, and all of the six *Scleropodium* Bruch & Schimp., species known from California are present. Eighteen bryophyte taxa (16 mosses and two liverworts) were added by our own collections since 2014. We separately list 22 taxa that we consider unconfirmed on the mountain because they are represented only by herbarium specimens that we could not locate, or for other reasons as given in the catalogue (Appendix 1). We counted a total of 1238 specimens as collected from the mountain, of which 451 were our own collections.

It is likely that additional species occur on the mountain, as yet undocumented. We note that 33 species have been confirmed there only once, and that we did not find 41 species documented there by earlier collectors. These facts imply that Mount Diablo is not yet fully explored in terms of bryophyte taxa collected there. Most of our own collecting was done along trails (see Fig. 1). Microhabitats away from trails will probably reveal additional taxa, and private land in the area is under-represented in our collections compared to public land.

The present list of those confirmed on the mountain represents about 21% of the approximately 650 moss taxa and about 14% of the approximately 167 liverwort and hornwort taxa known from the State of California (J. Shevock, California Academy of Sciences, personal communication; see also Norris and Shevock, 2004a; Doyle and Stotler 2006). Many Californian bryophytes occur mainly in high mountains, deserts, or the wet northwestern part of the State, and in many cases, it is unlikely that these would occur on Mount Diablo. A more relevant question is what fraction of bryophyte species known from broadly similar areas of North and Central California occur on Mount Diablo. This is difficult to answer because knowledge of bryophyte distributions in the State lags far behind that of vascular plants and accurate county lists of bryophytes for many nearby counties are not available. Whittemore (2020b) included 301 taxa in an online

TABLE 1. Summary of Bryophyte families and genera on Mt. Diablo. Number of species is given in parentheses for each family and genus.

Taxonomic Grouping	Family	Genus
Hornworts	Anthocerotaceae (1)	<i>Anthoceros</i> (1)
	Notothyladaceae (1)	<i>Phaeoceros</i> (1)
	Phymatocerotaceae (1)	<i>Phymatoceros</i> (1)
Liverworts	Aytoniaceae (3)	<i>Asterella</i> (3)
	Cephaloziellaceae (1)	<i>Cephaloziella</i> (1)
	Fossombroniaceae (2)	<i>Fossombronia</i> (2)
	Frullaniaceae (3)	<i>Frullania</i> (3)
	Gymnomitriaceae (1)	<i>Marsupella</i> (1)
	Lunulariaceae (1)	<i>Lunularia</i> (1)
	Porellaceae (2)	<i>Porella</i> (2)
	Ricciaceae (4)	<i>Riccia</i> (4)
	Scapaniaceae (1)	<i>Lophozia</i> (1)
	Sphaerocarpaceae (1)	<i>Sphaerocarpos</i> (1)
	Targioniaceae (1)	<i>Targionia</i> (1)
Mosses	Amblystegiaceae (2)	<i>Hygroamblystegium</i> (1)
		<i>Leptodictyum</i> (1)
	Andreaeaceae (1)	<i>Andreaea</i> (1)
	Bartramiaceae (3)	<i>Anacolia</i> (2)
		<i>Bartramia</i> (1)
	Brachytheciaceae (16)	<i>Brachytheciastrum</i> (1)
		<i>Brachythecium</i> (4)
		<i>Homalothecium</i> (4)
		<i>Kindbergia</i> (1)
		<i>Scleropodium</i> (6)
		<i>Anomobryum</i> (1)
		<i>Bryum</i> (3)
		<i>Gemmabryum</i> (4)
		<i>Imbribryum</i> (3)
		<i>Ptychostomum</i> (2)
		<i>Rosulabryum</i> (5)
		<i>Dendroalsia</i> (1)
		<i>Dicranella</i> (1)
		<i>Dicranoweisia</i> (1)
		<i>Ceratodon</i> (1)
		<i>Ditrichum</i> (1)
		<i>Pleuridium</i> (1)
	Encalyptaceae (1)	<i>Encalypta</i> (1)
	Fabroniaceae (1)	<i>Fabronia</i> (1)
	Fissidentaceae (4)	<i>Fissidens</i> (4)
	Funariaceae (2)	<i>Funaria</i> (2)
	Grimmiaceae (12)	<i>Grimmia</i> (11)
		<i>Schistidium</i> (1)
	Hedwigiaceae (3)	<i>Hedwigia</i> (2)
		<i>Pseudobraunia</i> (1)
	Lembophyllaceae (3)	<i>Bestia</i> (1)
		<i>Isothecium</i> (2)
	Leptodontaceae (1)	<i>Alsia</i> (1)
	Leskeaceae (1)	<i>Claopodium</i> (1)
	Leucodontaceae (2)	<i>Antitrichia</i> (1)
		<i>Nogopterium</i> (1)
	Mielichhoferiaceae (2)	<i>Epipterygium</i> (1)
		<i>Pohlia</i> (1)
	Mniaceae (1)	<i>Plagiomnium</i> (1)
	Neckeraceae (1)	<i>Neckera</i> (1)
	Orthotrichaceae (13)	<i>Amphidium</i> (1)
		<i>Lewinskya</i> (4)
		<i>Orthotrichum</i> (6)
		<i>Pulviger</i> (2)
	Plagiotheciaceae (1)	<i>Plagiothecium</i> (1)
	Polytrichaceae (3)	<i>Atrichum</i> (1)
		<i>Polytrichum</i> (2)

TABLE 1. CONTINUED

Taxonomic grouping	Family	Genus
	Pottiaceae (39)	<i>Aloina</i> (1) <i>Bryoerythrophyllum</i> (1) <i>Crossidium</i> (1) <i>Crumia</i> (1) <i>Didymodon</i> (10) <i>Eucladium</i> (1) <i>Gymnostomum</i> (2) <i>Hennediella</i> (1) <i>Pseudocrossidium</i> (1) <i>Syntrichia</i> (8) <i>Timmiella</i> (2) <i>Tortula</i> (9) <i>Weissia</i> (1)
	Ptychomitriaceae (1)	<i>Ptychomitrium</i> (1)

key to the mosses of the ten counties that are closest to San Francisco Bay, including Contra Costa County. Our total of 137 mosses on Mount Diablo represents about 46% of this number. Shevock and Toren (2001) reported 128 mosses for the City and County of San Francisco. Kellman (2003) reported 191 moss taxa for Santa Cruz County, to the south of and more coastal than Mount Diablo. Yurky (1995) reported 123 mosses, 65 liverworts and four hornworts for Marin County, to the northwest of Mount Diablo. Further south, Carter (2021) reported that 156 mosses, 31 liverworts and 5 hornworts are documented for San Luis Obispo County. To the north, Rae (2021) reported 158 moss species for Napa County and a thorough list of mosses has been published for Lake County by Toren (2015). This county has an area of about 1256 square miles, excluding lake surfaces. Its center is about 100 miles north of Mount Diablo and its maximum elevation is 7055 feet. It has 302 currently documented moss taxa (D. Toren, California Academic of Sciences, personal communication), meaning that Mount Diablo, with less elevation, less rainfall, and a small fraction of the area, has slightly more than 45% of the number of moss taxa known from Lake County.

As noted in our Introduction, the vascular plant flora of Mount Diablo contains several distinctive taxa that are confined to the mountain or are very restricted and rare elsewhere. This is less noticeable in the bryophyte flora, although two Mount Diablo taxa are listed by the California Native Plant Society Rare Plant Program (2020) as rare or uncommon in California. These are *Anomobryum julaceum* (Schrader ex P.Gaertn., B.Mey. & Scherb.) Schimp., rare in the western United States, but widespread elsewhere in temperate regions to high latitudes in both hemispheres, and *Grimmia torenii* Hastings, endemic to the State and a rare moss known only from Shasta to Monterey counties. *Grimmia mariniana* Sayre is uncommon elsewhere and endemic to western California, and *Bryum lanatum* (P.Beauv.) Brid. is known in California mainly from the Sierra Nevada and is uncommon in the Coast Ranges outside

Mount Diablo. California is well known for endemism in the vascular plant flora (Burge et al. 2016), but bryophytes in general have less regional endemism than vascular plants (Carter et al. 2016). So the absence of species unique or nearly unique to the mountain is not surprising.

We studied our Mount Diablo specimen database to obtain information about the distribution of taxa from different regions on the mountain itself. We divided a map of the mountain into five areas (Fig. 1) and recorded each taxon as present or absent in each area based on our specimen database. The areas roughly correspond to the north, south, east, and west sides of the mountain below about 2800 feet elevation, and separately the region above this level, including the summit. A weakness of this approach is that each of the areas was not equally visited, probably introducing bias into the numbers of taxa found there. Nevertheless, any strong differences in bryophyte diversity in different areas would probably show up in these numbers. We found broadly similar numbers of taxa in the north and south sections of the mountain (112 and 102 respectively). There were 74 taxa on the west side and 44 on the east side. The lower number of the east side possibly reflects fewer collections from there, but may also reflect the drier climate on the eastern slopes of the mountain.

Elevation, on the other hand, probably has an impact on bryophyte diversity on Mount Diablo. We found 76 taxa in the region above 2800 feet of which 10 taxa were collected only from this region and not from any lower region. Eighty-six taxa were absent from this upper region and were collected only lower down, leaving 63 taxa found in both elevation zones. The fewer taxa in the upper zone may partly reflect that it is smaller in area than the combined lower reaches of the mountain, but looking at the 10 taxa that are so far known only above 2800 feet on the mountain, we find several that are also primarily upland or montane species elsewhere in the State, implying a genuine montane element in the bryophyte flora of the summit area of Mount Diablo. Examples are *Andreaea heinemannii* Hampe &

Müll.Hal., *Grimmia alpestris* (F.Weber & D.Mohr) Schleich., *G. anodon* Bruch & Schimp., *G. ovalis* (Hedw.) Lindb., and *Tortula inermis* (Brid.) Mont.

Turning to regional affinities of the Mount Diablo bryophyte flora, we find that most of the taxa there are widespread in California in the Coast Ranges, north and south of the mountain and elsewhere in the State. Bryophyte distributions in California are incompletely known, but based on information from Wilson (2021) from the eFlora moss database and elsewhere, species that are absent or uncommon within the Coast Ranges south of Mount Diablo include *Andreaea heinemannii* and *Grimmia mariniana*.

Finally, consideration of conservation issues is warranted in relation to the bryophyte list. We note that Mount Diablo is highly protected compared to many areas of California, since much of it lies within the State Park, and many adjoining areas are also protected or have conservation easements, thanks in part to the efforts of groups such as Save Mount Diablo. Thus, it is unlikely that bryophyte diversity will be lost on the mountain due to direct human development or alteration of the land. However, pig damage, manzanita die-off, and wildfires are all current issues on the mountain and in addition many bryophytes are highly dependent on moisture. It has been estimated that coastal fog has declined by about 33% since the early twentieth century in California (Johnstone and Dawson 2010). Should a further drying trend develop or continue in the climate, some taxa could become vulnerable on Mount Diablo. Those most at risk are probably species that are mostly found in moister habitats to the north, or at higher, cooler elevations. Ephemeral mosses, such as *Tortula acaulon* (With.) R.H.Zander and *Pleuridium* Rabenh. species, may also be at risk because of their critical dependence on seasonal moisture in winter and early spring months. This situation is of course mirrored elsewhere, with moisture-loving bryophytes being at risk from areas that may be subject to increased drought, and perhaps corresponding expansion in range of those taxa that thrive in warmer, drier conditions. We hope that information in our list below may help provide a baseline to inform future studies on the status of Mount Diablo bryophytes.

NOTE: After this manuscript was accepted for publication, we found a significant number of additional unincorporated collections from Mount Diablo in un-accessioned boxes at the UC herbarium. We were unable to search for these earlier due to Covid restrictions. The collections are primarily by D.H. Norris and R. Robertson. We intend to examine these specimens and may write an addendum to this report if we find new taxa for Mount Diablo among them.

CATALOGUE INVENTORY OF BRYOPHYTES RECORDED FROM MOUNT DIABLO

The taxa listed below are presented alphabetically by genus and species, with the family assignation

given in parentheses after each name. Names used represent up-to-date taxonomic publications and opinions, but are our own choices where expert opinions still differ. In every case where our name (in bold font) differs from that used for the same taxon in the *Flora of North America North of Mexico* Vol. 27 (Flora North America Editorial Committee 2007), 28 (Flora North America Editorial Committee 2014) and 29 [Flora North America Editorial Committee *in prep*], we give the name cited there as a synonym below the name that we list.

Next, we give an assessment of the abundance of each taxon in our area of study, using four categories: rare, uncommon, common, or abundant. This assessment refers only to Mount Diablo and in no way reflects rarity in California as a whole, or elsewhere. We also note that our categories are rough estimates, based only on the number of collections and observations that we know about. Clearly, small or ephemeral species are likely to be found less easily than large showy ones, and this will introduce bias into our estimates. Similarly, some species may appear under-collected because they are restricted to specialized habitats, or may be common only within suitable sites. Given these caveats, a taxon is cited as rare on the mountain if it has only one record, uncommon if it has two or three, common if we know of four to eight collections, and abundant if we know it from nine or more separate collections.

After rarity assessment, we give brief notes on the habitat from which the Mount Diablo collections are known, distilled from the collectors' notes. We do not list habitat information on a specimen-by-specimen basis. We next list up to five individual collections (see Methods), giving location, elevation if known (converted to feet if originally in meters), month and year collected, collector and collection number, and herbarium abbreviation where the specimen is deposited. We have placed information in square brackets when it was added by us and is not mentioned on the specimen label.

In Appendix 1, we note taxa reported as occurring on Mount Diablo about which we remain doubtful, for reasons given in each case.

Abbreviations: CRRRA is Castle Rock Regional Recreation Area. MDSP is Mount Diablo State Park. Mt. Diablo is Mount Diablo. Mya is "million years ago".

HORNWORTS

Anthoceros fusiformis Austin (Anthocerotaceae)

Common. On moist soil in shady situations often near creeks in woods.

Headwaters of the small tributary which empties into Pine Creek at boundary between Diablo Foothills Regional Park and MDSP, 984 ft, Feb 2001, *Norris 100767* (UC); along White Canyon at Red Rd near end of Mitchell Canyon Rd in MDSP S of Clayton, 820 ft, Dec 2000, *Norris 100615* (UC); Morgan Territory Rd, about 8.3 mi north of junction with

North Livermore Rd, 492 ft, Apr 1997, *Doyle 8936* (UC); Rock City, Mt. Diablo [MDSP], May 1942, *Howell 588* (CAS).

Phaeoceros pearsonii (M.Howe) Prosk. (Notothyladaceae)

Uncommon. On shady soil on a bank or roadcut in mixed woodland.

On Finley Rd on private property bordering Morgan Territory Regional Preserve, 5 mi NE of San Ramon, 900 ft, Feb 2017, *Hutton 460* (CAS); Morgan Territory Rd, about 7.9 mi N of junction with North Livermore Rd, 150 ft, Apr 1997, *Doyle s.n.* (UC).

Phymatoceros bulbiculosus (Brot.) Stotler, W.T.Doyle & Crand.-Stotl. (Phymatocerotaceae)

Common. On soil, chaparral to semi-open woodland. Donner Canyon, along Donner Canyon Rd near junction with Hetherington Trail, [MDSP], 1000 ft, Jan 2001, *Shevock 20309* (CAS); along Back Creek Trail in MDSP, near Clayton, 820 ft, Mar 2007, *Norris 109844* (UC); E side Mt. Diablo, 7 mi from Clayton on road to Livermore, Mar 1931, *Howell 56* (CAS); by an unnamed stream in Perkins Canyon, MDSP, Apr 2016, *Game 16/040B* (UC).

LIVERWORTS

Asterella californica (Hampe ex Austin) Underw. (Aytoniaceae)

Abundant. On moist soil banks in shade in woodland or chaparral.

At Morgan Sulfur Spring, on side trail off Clark Canyon Trail, off Curry Canyon Rd, on private property, 6.6 mi SE of Clayton, 1252 ft, Jan 2017, *Hutton 430A* (CAS); on Sulfur Spring Trail at sulfur spring and junction with spur trail, Morgan Territory Regional Preserve, 8.1 mi NE of San Ramon, 1013 ft, Feb 2017, *Hutton 455D* (CAS); along Knobcone Point Rd, near Balancing Rock, MDSP, 1877 ft, Mar 2017, *Hutton 473A* (CAS); trail to waterfalls below Mt. Diablo Peak, Donner Canyon [MDSP], 1200 ft, Feb 2004, *Shevock 24618* (CAS); along Trail Through Time, Rock City, MDSP, 5.3 mi NE of San Ramon, 1384 ft, Jun 2016, *Hutton 383A* (CAS).

Asterella bolanderi (Austin) Underw. (Aytoniaceae)

Rare. On moist soil of creek bank in forest. Headwaters of the small tributary which empties into Pine Creek at boundary between Diablo Foothills Regional Park and MDSP, 984 ft, Feb 2001, *Norris 100768* (UC).

Asterella palmeri (Austin) Underw. (Aytoniaceae)

Common. Moist soil in woods or chaparral. Along Three Springs Trail immediately southwest of Rhyne Mine in MDSP, 1558 ft, Feb 2001, *Norris 100819* (UC); along White Canyon at Red Rd near end of Mitchell Canyon Rd in MDSP, 820 ft, Dec 2000, *Norris 100598* (UC); headwaters of small tributary which empties into Pine Creek at boundary between Diablo Foothills Regional Park and MDSP, 984 ft, Feb 2001, *Norris 100772* (UC); Donner Falls

Trail, N side of Mt. Diablo, [MDSP], Jan 2001, *Ertter s.n.* (UC); along West Fork Sycamore Canyon near trail from Lower Rock City, MDSP, 1969 ft, Dec 2000, *Norris 100509* (UC).

Cephaloziella divaricata (Sm.) Schiffn. (Cephalozielaceae)

Common. On soil or rock in bright or filtered light in woodland.

Mt. Diablo, Feb 1896, *Howe s.n.* (NY); along Knobcone Pt Rd near Balancing Rock, MDSP, 1650 ft, Mar 2017, *Hutton 477B* (CAS); on bank to right of deserted cabin on Sulfur Spring Trail at sulfur spring and junction with spur trail, Morgan Territory Regional Preserve, 8.1 mi NE of San Ramon, 1013 ft, Feb 2017, *Hutton 455F* (CAS); below observation deck of Mt. Diablo Peak above boardwalk trail, [MDSP], 3750 ft, Feb 2004, *Shevock 24637* (CAS); along Three Springs Trail immediately SW of Rhyne Mine, [MDSP], 1558 ft, Feb 2001, *Norris 100852* (UC).

Fossombronía longiseta (Austin) Austin (Fossombronniaceae)

Abundant. On soil or soil over rock in mixed woodland.

At Morgan Sulfur Spring, on side trail off Clark Canyon Trail, off Curry Canyon Rd, on private property surrounded by MDSP, 6.6 mi SE of Clayton, 1252 ft, Jan 2017, *Hutton 430B* (CAS); on bank to right of deserted cabin on Sulfur Spring Trail at sulfur spring and junction with spur trail, Morgan Territory Regional Preserve, 8 mi NE of San Ramon, 1013 ft, Feb 2017, *Hutton 455C* (CAS); along Knobcone Point Rd to Balancing Rock, MDSP, 6 mi NE of San Ramon, 1659 ft, Mar 2017, *Hutton 464C* (CAS); along White Canyon at Red Rd near end of Mitchell Canyon Rd in MDSP, S of Clayton, 820 ft, Dec 2000, *Norris 100608* (UC); along Ohlone Trail, Lime Ridge Open Space, 5.08 mi NE of Walnut Creek, 555 ft, Feb 2020, *Hutton 632B* (CAS).

Fossombronía pusilla (L.) Nees (Fossombronniaceae)

Uncommon. On moist, sunny to partly shaded soil or shale outcrops in forest.

Along Three Springs Trail immediately southwest of Rhyne Mine [MDSP], 1558 ft, Feb 2001, *Norris 100826* and *100835* (UC); headwaters of the small tributary which empties into Pine Creek at boundary between Diablo Foothills Regional Park and MDSP, 984 ft, Feb 2001, *Norris 100776* (UC).

Frullania bolanderi Austin (Frullaniaceae)

Abundant. Epiphytic on tree bark in diffuse light or shade.

Mt. Diablo, Feb 1896, *Howe s.n.* (UC); along trail to Rock Ridge from Juniper Campground, MDSP, 3445 ft, Mar 2001, *Norris 101091* (UC); along White Canyon at Red Rd near end of Mitchell Canyon Rd in MDSP, S of Clayton, 820 ft, Dec 2000, *Norris 100605* (UC); on N-facing slopes of Pine Ridge above Pine Pond in MDSP, 623 ft, Feb 2001, *Norris 100741* (UC); along Three Springs Trail immediately SW of

Rhyne Mine in MDSP, 1558 ft, Feb 2001, *Norris 100848* (UC).

Frullania californica (Austin ex Underw.) A. Evans (Frullaniaceae)

Uncommon. On rock outcrop in woodland.

Rock City Region, Sycamore Fire Rd above junction with Trail Through Time, Forks of Sycamore Creek, MDSP, 1200 ft, Jan 2004, *Shevock 24535* (CAS); along West Fork Sycamore Canyon near trail from Lower Rock City, 1969 ft, Dec 2000, *Norris 100557* (UC); along Trail Through Time, Rock City, MDSP, 1533 ft, Nov 2019, *Hutton 610A* (CAS).

Frullania nisquallensis Sull. (Frullaniaceae)

Rare. On heavily shaded rock outcrop in mixed woodland.

Along Trail Through Time, Rock City, MDSP, 1533 ft, Nov 2019, *Hutton 610B* (CAS).

Lophozia sp. (Dumort.) Dumort. (Lophoziaceae).

Rare. On moist, rather shaded vertical face of sandstone outcrop in *Adenostoma* Hook. & Arn., chaparral in *Quercus agrifolia* forest.

Along West Fork Sycamore Canyon near trail from Lower Rock City, [MDSP], 1969 ft, Dec 2000, *Norris 100543* and *100544* (UC).

Without fresh material, we are not able to identify these *Lophozia* (Dumort.) Dumort. specimens to species.

Lunularia cruciata (L.) Dumort. ex Lindb. (Lunulariaceae)

Common. On soil banks or boulders in mixed forest. Naturalized in California from Europe.

Along Trail Through Time, near junction with Sycamore Creek Trail, MDSP, 1221 ft, Jun 2016, *Hutton 387A* (CAS); along Summit Trail in Dan Cook Canyon, MDSP, 3.3 mi NE of Danville, 918 ft, Oct 2015, *Hutton 250* (CAS); headwaters of the small tributary which empties into Pine Creek at boundary between Diablo Foothills Regional Park and MDSP [Pine Canyon], 984 ft, Feb 2001, *Norris 100766* (UC); along Back Creek Trail in MDSP, near Clayton, 820 ft, Mar 2007, *Norris 109820* (UC); at Morgan Sulfur Spring, on side trail off Clark Canyon Trail, off Curry Canyon Rd, on private property, ca. 1250 ft, Jan 2017, *Game 17/002* (UC).

Marsupella bolanderi (Austin) Underw. (Gymnomitriaceae)

Rare. On moist, diffusely lit mineral soil in *Adenostoma* chaparral in *Quercus agrifolia* forest.

Along West Fork Sycamore Canyon near trail from Lower Rock City [MDSP], 1969 ft, Dec 2000, *Norris 100533*, *100538*, *100540* (UC).

Porella bolanderi (Austin) Pearson (Porellaceae)

Abundant. Mostly on moist to wet rock or bark in shade.

Along Olympia Trail just below the summit of North Peak [MDSP], 3130 ft, Jan 2004, *Shevock 24569* (CAS); on Curry Canyon Rd between junctions with

Knobcone Point Rd and Frog Pond Rd, MDSP, 1757 ft, Jun 2015, *Hutton 173B* (CAS); near upper end of Bald Ridge Trail, MDSP, Jun 2004, *Game 04/050B* (UC); at end of China Wall Rd, at China Wall rock outcrop, MDSP, 824 ft, Aug 2016, *Hutton 404* (CAS); Mitchell's Canyon, Mt. Diablo, Feb 1896, *Howe s.n.* (UC).

Porella cordaeana (Huebener) Moore (Porellaceae)

Common. On moist rock or bark in woodland.

Along Bald Ridge Trail, near Prospector's Gap, MDSP, 2936 ft, Apr 2017, *Hutton 519A* (CAS); Rock City Region, along Trail Through Time at junction with Devil's Slide Trail, W fork of Sycamore Creek [MDSP], 1200 ft, Jan 2004, *Shevock 24523* (CAS); Donner Canyon, trail to waterfalls below Mt. Diablo Peak [MDSP], 1200 ft, Feb 2004, *Shevock 24629* (CAS); Pine Canyon, along Stage Rd, MDSP, 589 ft, Jun 2014, *Hutton 4A* (CAS); along trail to Mt. Olympia, northern flank of North Peak [MDSP], 1550 ft, Feb 2004, *Shevock 24579* (UC).

Riccia californica Austin (Ricciaceae)

Rare. On moist soil over rock in partial shade in mixed *Umbellularia/Quercus* woodland.

Along Rock City Trail, off Wallpoint Rd, MDSP, 4 mi NE of Danville, 1724 ft, Nov 2014, *Hutton 51A* (CAS).

Riccia nigrella DC. (Ricciaceae)

Common. On moist diffusely lit soil.

Along West Fork Sycamore Canyon near trail from Lower Rock City, MDSP, 1969 ft, Dec 2000, *Norris 100552* (UC); along White Canyon at Red Rd near end of Mitchell Canyon Rd in MDSP, S of Clayton, 820 ft, Dec 2000, *Norris 100591* (UC); canyon back of Diablo stock farm, W of Wall Point, Mt. Diablo [MDSP], Mar 1933, *A. Carter 271* (UC); Mitchell's Canyon, Mt. Diablo, Feb 1896, *Howe s. n.* (NY).

Riccia sorocarpa Bisch. (Ricciaceae)

Common. Moist soil in sun to partial shade.

Donner Canyon, trail to the waterfalls below Mt. Diablo Peak, [MDSP], 1325 ft, Feb 2004, *Shevock 24627* (CAS); along West Fork Sycamore Canyon near trail from lower Rock City, MDSP, Mar 2006, 1476 ft, *Norris 100529*, *100532* (UC); in Lime Ridge County Reserve near NW corner of MDSP, 984 ft, Apr 2001, *Norris 101323*, *101327* (UC); back of Diablo stock farm, W of Wall Point, Mt. Diablo, [MDSP], Mar 1933, *A. Carter 272* (UC); Whitehill Cañon, Mt. Diablo, *Howe s.n.* Feb 1896 (NY).

Riccia trichocarpa M. Howe (Ricciaceae)

Uncommon. On soil in sun to partial shade.

Along West Fork Sycamore Canyon near trail from Lower Rock City, MDSP, 1969 ft, Dec 2000, *Norris 100530* (UC); in Lime Ridge County Reserve near NW corner of MDSP, 984 ft, Apr 2001, *Norris 101342*, *101353* and *101366* (UC); E side Mt. Diablo near summit, [MDSP], Feb 1941, *Howell 527* (CAS).

Sphaerocarpos texanus Austin (Sphaerocarpaceae)

Common. On moist, diffusely lit to sunny soil in chaparral or forest.

Along White Canyon at Red Rd near end of Mitchell Canyon Rd in MDSP, S of Clayton, 820 ft, Dec 2000, *Norris 100588* (UC); S of Briones-Mt. Diablo Trail at China Wall, MDSP, 984 ft, Apr 2001, *Norris 101437* (UC); along Three Springs Trail immediately SW of Rhyne Mine in MDSP, 1558 ft, Feb 2001, *Norris 100856* (UC); in Lime Ridge County Reserve near NW corner of MDSP, 984 ft, Apr 2001, *Norris 101365* (UC); headwaters of the small tributary which empties into Pine Creek at boundary between Diablo Foothills Regional Park and MDSP, 984 ft, Feb 2001, *Norris 100789* (UC).

Targionia hypophylla L. (Targioniaceae)

Abundant. On moist soil or soil over rock in partial sun to shade.

On Sulfur Spring Trail at sulfur spring and junction with spur trail, Morgan Territory Regional Preserve, 8 mi NE of San Ramon, 1013 ft, Feb 2017, *Hutton 456A* (CAS); along Back Creek Trail, Back Canyon, MDSP, 2 mi S of Clayton, 756 ft, Mar 2016, *Hutton 326C.1* (CAS); along Curry Canyon Rd between junctions with Knobcone Point Rd and Frog Pond Rd, MDSP, 1305 ft, Jun 2015, *Hutton 162* (CAS); along trail to Mt. Olympia, northern flank of North Peak, 1950 ft, Feb 2004, *Shevock 24592* (CAS); center of John Ginocchio's Arroyo Del Cerro private property south of pond [1.89 mi SE of North Gate Rd entrance to MDSP], 1202 ft, Apr 2018 *Ludwig 626* (CAS).

MOSSES

Aloina aloides (Koch ex Schultz) Kindb. var. **ambigua** (Bruch & Schimp.) E.J.Craig (Pottiaceae)

Uncommon. On moist, diffusely lit clay soil in forest. Headwaters of the small tributary which empties into Pine Creek at boundary between Diablo Foothills Regional Park and MDSP, 984 ft, Feb 2001, *Norris 100785* (UC); near Ohlone Trail, Lime Ridge Open Space, 470 ft, Feb 2020, *Game 20/085* (UC); *loc. cit.*, same date, *Hutton 640A* (CAS).

Alsia californica (Hook. & Arn.) Sull. (Leptodontaceae)

Common. On boulders, trees or rock in well lit to partly shaded places.

Dan Cook Canyon, Oct 2015, *B. Tan s.n.* (UC); along trail in Perkins Canyon, MDSP, 4.7 mi SE of Clayton, 725 ft, Aug 2015, *Hutton 234A* (CAS); Knobcone Pt Rd to Balancing Rock, MDSP, 5.9 mi NW of San Ramon, 1720 ft, Dec 2016, *Hutton 418A* (CAS); at end of China Wall Rd at China Wall rock outcrop, MDSP, 831 ft, Aug 2016, *Hutton 407* (CAS); along Trail Through Time at junction with Devil's Slide Trail, West Fork of Sycamore Creek [MDSP], 1200 ft, Jan 2004, *Shevock 24524* (CAS).

Amphidium californicum (Hampe ex Müll.Hal.) Broth. (Orthotrichaceae)

Abundant. On boulders, rock outcrops and moist soil over rock, in partial shade.

Along trail in Back Canyon, MDSP, 2 mi S of Clayton, Mar 2016, 756 ft, *Hutton 326B* (CAS); along Olympia Trail just below summit of North Peak, 3130 ft, Jan 2004, *Shevock 24565* (CAS); along Trail Through Time, Rock City, MDSP, 1534 ft, Jun 2015, *Hutton 180* (CAS); along White Canyon at Red Rd near Mitchell Canyon Rd in MDSP, 820 ft, Dec 2000, *Norris 100622* (UC); at Gibraltar (sic) along road to summit MDSP, 1947, *Koch 1570* (MICH, UC).

Anacolia baueri (Hampe) Paris (Bartramiaceae)

Anacolia menziesii (Turner) Paris

On thin soil and rock outcrops in sun to partial shade.

Along trail just S of Mt. Diablo Mine, adjacent to Perkins Canyon, MDSP, 4.2 mi SE of Clayton, 1352 ft, Apr 2016, *Hutton 344C* (CAS).

This species is not recognized as distinct from *A. menziesii* (Turner) Paris by Griffin (2014), but is considered distinct by most California bryologists and we therefore recognize it here.

Anacolia menziesii (Turner) Paris (Bartramiaceae)

On soil or rock in partial shade.

Mary Bowerman Trail, at Mt. Diablo summit, MDSP, 3660 ft, Jan 2015, *Hutton 70* (CAS).

Anacolia Schimp., spp.: additional collections.

We are not able to distinguish the above two *Anacolia* species without sporophytes. Most of the *Anacolia* collections from Mount Diablo, apart from those listed above, do not have sporophytes. To emphasize that *Anacolia* as a genus is abundant on Mt. Diablo, we list the following collections where we cannot be sure which of the two species is represented:

Along Bald Ridge Trail, near Prospector's Gap, MDSP, 2936 ft, Apr 2017, *Hutton 519C* (CAS); Donner Canyon, along upper Middle Trail just before junction with Falls Trail, [MDSP], 1400 ft, Jan 2001, *Shevock 20316* (CAS); along Knobcone Pt Rd, close to Balancing Rock, MDSP, 1832 ft, Mar 2017, *Hutton 472* (CAS); E-facing slopes along North Peak Trail between Devil's Elbow and Prospector's Gap, 3475 ft, Jan 2004, *Shevock 24552* (CAS); along White Canyon at Red Rd near Mitchell Canyon Rd in MDSP, 820 ft, Dec 2000, *Norris 100614* (UC); along Three Springs Trail immediately SW of Rhyne Mine in MDSP, 1558 ft, Feb 2001, *Norris 100817* (UC); along North Gate Rd at crossing of Little Pine Creek, Jan 2004, *Shevock 24514* (CAS); along trail to Mt. Olympia, northern flank of North Peak, [MDSP], Feb 2004, *Shevock 24598* (CAS).

Andreaea heinemannii Hampe & Müll.Hal. (Andreaeaceae)

Rare. On large metamorphic boulders and rock outcrops.

Below observation deck of Mt. Diablo Peak above boardwalk trail, [MDSP], 3750 ft, Feb 2004, *Shevock & Game 24636* (CAS).

Anomobryum julaceum (Schrader. Ex G.Gaertn., B.Mey. & Scherb.) Schimp. (Bryaceae)

Rare. On moist, rather shaded vertical face of sandstone outcrop, in *Adenostoma* chaparral in *Quercus agrifolia* forest.

Along West Fork Sycamore Canyon near trail from Lower Rock City, 1969 ft, Dec 2000, *Norris 100541* (CAS).

Antitrichia californica Sull. Ex Lesq. (Leucodontaceae)

Abundant. On rock or bark, in sun or shade.

At Morgan Sulfur Spring, on side trail off Clark Canyon Trail, off Curry Canyon Rd, on private property, 6.6 mi SE of Clayton, 1252 ft, Jan 2017, *Hutton 434A* (CAS); along Trail Through Time, Rock City, MDSP, 1588 ft, Jun 2016, *Hutton 376* (CAS); along North Peak Rd, Mar 2015, *Hutton 98B* (CAS); Mary Bowerman Trail at the summit, [MDSP], 3672 ft, Feb 2017, *Ludwig 209* (CAS); by creek, Mitchell Canyon, MDSP, Feb 2015, *Tan 2014-314* [sic] (UC).

Atrichum selwynii Austin (Polytrichaceae)

Common. On shady soil banks.

Rock City, Trail Through Time, [MDSP], 1545 ft, Jun 2016, *Tan s.n.* (UC); along Trail Through Time close to junction with Devil's Slide Trail, Rock City, MDSP, 1279 ft, Jun 2016, *Hutton 386A* (CAS); along Trail Through Time at junction with Devil's Slide Trail, MDSP, 1200 ft, Jan 2004, *Shevock 24521* (UC); in West Fork Sycamore Canyon, along trail to Lower Rock City, MDSP, 1969 ft, Dec 2000, *Norris 100482* (CAS).

Bartramia aprica Müll.Hal. (Bartramiaceae)

Bartramia stricta Brid., misapplied

Uncommon. On rock or exposed clay soils from sandstones, open slope in woodland.

Pine Canyon along road below Castle Rocks (Sunset Trail) at Castle Rocks [Regional] Recreation Area, 480 ft, Feb 2001, *Shevock 20361* (CAS); on rocks, Mitchell's Canyon, Mt. Diablo, Feb 1896, *Howe s.n.* (NY)

Bestia longipes (Sull. & Lesq.) Broth. (Lembophyllaceae)

Common. On earth, rock, or boulders in shade.

Dan Cook Canyon, Oct 2015, *Tan s.n.* (UC); on a side spur trail off Sulfur Spring Trail, Morgan Territory Regional Preserve, close to border with private property, 7.7 mi NE of San Ramon, 950 ft, Feb 2017, *Hutton 459A* (CAS); along Summit Trail in Dan Cook Canyon, MDSP, 3.6 mi NE of Danville, 1025 ft, Oct 2015, *Hutton 254* (CAS); Rock City region, junction of Trail Through Time with Sycamore Fire Rd, [MDSP], 1100 ft, Jan 2004, *Shevock 24528* (CAS); East Fork Sycamore Creek, Rock City Region, MDSP, Sycamore Fire Rd above

junction with Trail Through Time, 1100 ft, Jan 2004, *Shevock 24531* (CAS).

Brachytheciastrum velutinum (Hedw.) Ignatov & Huttunen (Brachytheciaceae)

Common. On moist soil or soil over rock, sun to shade.

Along Trail Through Time, close to junction with Devil's Slide Trail, Rock City, MDSP, 1279 ft, Jun 2016, *Hutton 386B* (CAS); along trail just S of Mt. Diablo Mine, adjacent to Perkins Canyon, MDSP, 3.5 mi SE of Clayton, 1094 ft, Apr 2016, *Hutton 340A.2* (CAS); trail between Mitchell Canyon Trailhead and Back Creek Trail, MDSP, 1 mi S of Clayton, 750 ft, Mar 2016, *Hutton 319A* (CAS); at Frog Pond on Frog Pond Trail, MDSP, 1532 ft, Jun 2015, *Hutton 169* (CAS); along North Peak Trail between Devil's Elbow and Prospector's Gap, [MDSP], 3150 ft, Jan 2004, *Shevock 24561* (CAS).

Brachythecium albicans (Hedw.) Schimp. (Brachytheciaceae)

Common. On soil or rock in filtered light.

Side trail, Rock City, Trail Through Time, [MDSP], 1320 ft, Jun 2016, *Tan s.n.* (UC); along Knobcone Pt Rd, near Balancing Rock, Mt Diablo State Park, 6.2 mi NE of San Ramon, 1902 ft, Mar 2017, *Hutton 475B* (CAS); along trail to Mt. Olympia, northern flank of North Peak, [MDSP], 1800 ft, Feb 2004, *Shevock 24589* (CAS); along Back Creek Trail to MDSP near Clayton, 820 ft, Mar 2007, *Norris 109828* (CAS); Mitchell's Canyon, Mt. Diablo, Feb 1896, *Howe s.n.* (CAS).

Brachythecium asperrimum (Mitt. ex Müll.Hal.) Sull. (Brachytheciaceae)

Uncommon. Moist soil in partial shade.

Along West Fork Sycamore Canyon near trail from Lower Rock City, [MDSP], 1969 ft, Dec 2000, *Norris 100539* (UC); a few yards above a trail near an unnamed creek that flows into Perkins Creek, Perkins Canyon, MDSP, elevation about 1050 ft, Apr 2016, *Game 16/040* (UC).

Brachythecium frigidum (Müll.Hal.) Besch. (Brachytheciaceae)

Rare. Along stream over exposed rock with calcium influence.

Donner Canyon, along Falls Trail above junction with Middle Trail, [MDSP], 1500 ft, Jan 2001, *Shevock 20325* (CAS).

Brachythecium rutabulum (Hedw.) Schimp. (Brachytheciaceae)

Rare. On moist, diffusely lit soil bank of rivulet in forest.

Along White Canyon at Red Rd near end of Mitchell Canyon Rd, [MDSP], 820 ft, Dec 2000, *Norris 100609* (CAS).

Bryoerythrophyllum columbianum (F.J.Herm. & E.Lawton) R.H.Zander (Pottiaceae)

Uncommon. On metamorphic rock or moist sunny soil.

About the summit, at summit ridge of Mt. Olympia, northern flank of North Peak, [MDSP], 2871 ft, Feb 2004, *Shevock 24609* (CAS); along Eagle Peak Trail near Mitchell Rock, MDSP, 1476 ft, Mar 2006, *Norris 108798* (UC); along Back Creek Trail in MDSP near Clayton, 820 ft, Mar 2007, *Norris 109854* (UC).

Bryum argenteum Hedw. (Bryaceae)

Common. On soil or rock, sun to shade.

At edge of parking lot, Mitchell Canyon trailhead parking area, MDSP, 1.5 mi S of Clayton, 583 ft, Mar 2016, *Hutton 318A.1* (CAS); Mary Bowerman Trail, at Mt. Diablo summit, MDSP, 3674 ft, Feb 2016, *Hutton 291A.2* (CAS); Curry Point, Feb. 2016, *Tan s.n.* (UC); at summit ridge of Mt. Olympia, northern flank of North Peak, 2871 ft, Feb 2004, *Shevock 24607* (CAS); headwaters of the small tributary which empties into Pine Creek at boundary between Diablo Foothills Regional Park and MDSP, 984 ft, Feb 2001, *Norris 100790* (UC)

Bryum lanatum (P.Beauv.) Brid. (Bryaceae)

Rare. On soil over rock in filtered light.

Along West Fork Sycamore Canyon near trail from Lower Rock City, [MDSP], 1969 ft, Dec 2000, *Norris 100524* (UC).

Bryum Hedw., sp., s. l. (Bryaceae)

Uncommon. On soil and soil over rock, mixed riparian woodland.

Perkins Canyon, [MDSP], Apr 2016, *Tan s.n.* (UC); at streamlet crossing, along trail to south of Mt. Diablo Mine and to north of Perkins Canyon, MDSP, 4.5 mi SE of Clayton, 794 ft, Apr 2016, *Hutton 346A* (CAS); at Devil's Elbow near top of Mt. Diablo, MDSP, 3281 ft, Dec 2000, *Norris 100568* (UC).

D. Toren (California Academy of Sciences, personal communication) has informed us that these three collections belong to a moss that is known from California, but has been misidentified in the past as *Ptychostomum cyclophyllum* (Schwägr.) J.R.Spence (Bryaceae). Work is in progress to resolve the correct placement and circumscription of this currently unnamed moss.

Ceratodon purpureus (Hedw.) Brid. (Ditrichaceae)

Common. Dry rock in filtered light.

Rock City, [MDSP], Nov 2014, *Tan 2014-309* (UC); on Knobcone Point Rd, near Balancing Rock, MDSP, 1676 ft, Mar 2017, *Hutton 467B* (CAS); Mitchell Canyon, MDSP, Dec 2000, *Game 00/001B* (UC); at Gibraltar (sic) along road to summit in MDSP, May 1947, *Koch 1580* (MICH); at Morgan Sulfur Spring, on side trail off Clark Canyon Trail, off Curry Canyon Rd, on private property surrounded by MDSP, 1252 ft, Jan 2017, *Hutton 429B.2* (CAS).

Claopodium whippleanum (Sull.) Renauld & Cardot (Leskeaceae)

Common. On soil or soil over rock or boulders in filtered light.

Near spring, North Peak Rd, MDSP, 3000 ft, Feb 2015, *Tan 2015-108* (UC); at Morgan Sulfur Spring, on side trail off Clark Canyon trail, off Curry Canyon Rd, on private property surrounded by MDSP, 6.6 mi SE of Clayton, 1252 ft, Jan 2017, *Hutton 432* (CAS); along Stage Rd in Diablo Foothills Regional Park, bordering MDSP, Pine Canyon, 3.2 mi NE of Alamo, 432 ft, Jul 2014, *Hutton 7B* (CAS); along Summit Trail through Dan Cook Canyon, bordering MDSP, 3 mi NE of Danville, 798 ft, Oct 2015, *Hutton 247A* (CAS); at dry sulfur spring, on side trail off Devil's Slide Trail, Rock City, MDSP, 4.7 mi NE of Danville, 1420 ft, Jun 2015, *Hutton 185B* (CAS).

Crossidium squamiferum (Viv.) Jur. (Pottiaceae)

Uncommon. Rock outcrops in diffuse light.

Donner Canyon, off of Falls Trail above junction with Middle Trail, [MDSP], 1500 ft, Jan 2001, *Shevock 20332* (CAS); headwaters of small tributary which empties into Pine Creek at boundary between Diablo Foothills Regional Park and MDSP, 984 ft, Feb 2001, *Norris 100760* (UC); trail to the waterfalls below Mt. Diablo Peak in Wild Oat Canyon area, MDSP, 1650 ft, Feb 2004, *Shevock 24622* (CAS).

Crumia latifolia (Kindb.) W.B.Schofield (Pottiaceae)

Common. Confined to stream beds or by streams.

At a small waterfall uphill from Back Canyon towards Eagle Peak, MDSP, Jan 2006, *Game 06/001* (UC); along Burma Rd to Long Ridge, MDSP, 4.6 mi NE of Danville, 1487 ft, Oct 2015, *Hutton 264* (CAS); along trail on north side of Perkins Canyon where streamlet crosses trail, Perkins Canyon, MDSP, 4.6 mi SE of Clayton, 794 ft, Apr 2016, *Hutton 346B* (CAS); south of Briones-Mt. Diablo Trail at China Wall, MDSP, 984 ft, Apr 2001, *Norris 101413* (UC); Donner Canyon, along Falls Trail above junction with Middle Trail, MDSP, 1500 ft, Jan 2001, *Shevock 20323* (CAS).

Dendroalsia abietina (Hook.) E.Britton ex Broth. (Cryphaeaceae)

Common. On tree trunks in shade or diffuse light.

At side of trail along Stage Rd, near junction with Sunset Trail, Pine Canyon, [MDSP], 3.4 mi NE of Alamo, 528 ft, Jun 2014, *Hutton 5* (CAS); Mary Bowerman Trail, at Mt. Diablo summit, MDSP, 4.1 mi S of Clayton, 3730 ft, Jan 2015, *Hutton 74* (CAS); Donner Canyon, along Falls Trail above junction with Middle Trail, [MDSP], 1500 ft, Jan 2001, *Shevock 20324* (CAS); in West Fork Sycamore Canyon along trail to Lower Rock City, [MDSP], 1969 ft, Dec 2000, *Norris 100493* (UC); along trail to Rock Ridge from Juniper Campground, [MDSP], 3445 ft, Mar 2001, *Norris 101072* (UC).

Dicranella varia (Hedw.) Schimp. (Dicranaceae)

Uncommon. On shaded metamorphic rocks and moist soil.

Off of trail to Mt. Olympia, northern flank of North Peak, MDSP, 2034 ft, Feb 2004, *Shevock 24614* (CAS) [as *Dicranella howei* Renauld & Cardot]; along Ohlone Trail, Lime Ridge Open Space, 550 ft, Feb 2020, *Hutton 631A* (CAS).

We are here following Crum (2014) in treating *Dicranella howei* Renauld & Cardot as a synonym of *Dicranella varia*.

Dicranoweisia cirrata (Hedw.) Lindb. ex Milde (Dicranaceae)

Common. On bark of trees or logs in diffuse light. Along Mitchell Canyon Rd at junction with Red Rd, MDSP, 2 mi SW of Clayton, 763 ft, Aug 2015, *Hutton 212* (CAS); along trail to Mt. Olympia, northern flank of North Peak, [MDSP], 1650 ft, Feb 2004, *Shevock 24584* (CAS); along North Gate Rd 0.4 mi above Oak Knoll Picnic Area, [MDSP], 2800 ft, Jan 2004, *Shevock 24501* (CAS); along upper Middle Trail just before junction with Falls Trail, [MDSP], 1400 ft, Jan 2001, *Shevock 20317* (CAS); along Eagle Peak trail near Mitchell Rock, [MDSP], 1476 ft, Mar 2006, *Norris 108795* (UC).

Didymodon australasiae (Hook. & Grev.) R.H.Zander (Pottiaceae)

Rare. Above stream in woodland, on clay-like soil bank of trail.

Donner Canyon, trail to the waterfalls below Mt. Diablo Peak in Wild Oat Canyon area, [MDSP], 1650 ft, Feb 2004, *Shevock 24625* (CAS).

Additional collections (not seen) listed in the Consortium of North American Bryophyte Herbaria database as *Trichostomopsis* Cardot may be this taxon. They are *Koch 1556*, Mt. Diablo, May 1947 (ILL) and *Koch 3307*, 3318, and 3326, Mitchell Canyon, Mt. Diablo, Oct 1950 (all ILL). *Trichostomopsis* species have been reassigned to *Didymodon* by Jiménez et al. (2004), including *D. australasiae* as the only one otherwise represented on Mt. Diablo. For the purposes of rarity assessment on the mountain we include only the *Shevock 24625* (CAS) collection.

Didymodon bistratosus Hébr. & R.B.Pierrot (Pottiaceae)

Uncommon. On soil over rock, in sun.

Rock City, Nov 2014, *Tan 2014-308* (UC); along Curry Canyon Rd, at junction with Knobcone Pt Rd, Curry Point, 4.5 mi NE of Danville, 1784 ft, Feb 2016, *Hutton 288D* (CAS); along West Fork Sycamore Canyon near trail from Lower Rock City, MDSP, 1969 ft, Dec 2000, *Norris 100526* (UC).

Didymodon brachyphyllus (Sull.) R.H.Zander (Pottiaceae)

Common. On sandstone or brightly lit sandy or calcareous soil or boulders.

S. side of Mt. Diablo [MDSP], ca. 1000 ft, May 1955, *Howell s.n.* (CAS); at edge of parking lot, Mitchell Canyon trailhead parking area, MDSP, 1.5 mi S of Clayton, 597 ft, Jan 2017, *Hutton 420C* (CAS);

headwaters of the small tributary which empties into Pine Creek at boundary between Diablo Foothills Regional Park and MDSP, 984 ft, Feb 2001, *Norris 100792* (UC); along Ohlone Trail, Lime Ridge Open Space, 5.08 mi NE of Walnut Creek, 464 ft, Feb. 2020, *Hutton 638A* (CAS).

Didymodon eckeliae R.H.Zander (Pottiaceae)

Common. On soil over rock or boulders or tree trunks in partial shade.

On bankside of Donner Creek along Cardinet Oaks Rd at crossing of Donner Creek, Donner Canyon, MDSP, 2.8 mi SE of Clayton, 1046 ft, Mar 2015, *Hutton 114B.1* (CAS); near parking [area], trail margin, Mitchell Creek, [MDSP], 763 ft, Aug 215, *Tan s.n.* (UC); along White Canyon at Red Rd near end of Mitchell Canyon Rd, [MDSP], 820 ft, Dec 2000, *Norris 100603* (UC); along Ohlone Trail, Lime Ridge Open Space, 4.98 mi NE of Walnut Creek, CA, 560 ft, Feb 2020 *Hutton 637B* (CAS).

Didymodon fallax (Hedw.) R.H.Zander (Pottiaceae)

Uncommon. On moist soil banks in shade.

Along Green Ranch Rd close to where Mountain Spring Creek crosses road, MDSP, 5.6 mi NE of Danville, 2634 ft, Apr 2016, *Hutton 361B* (CAS), *loc. cit.*, same date, *Tan s.n.* (UC); along Knobcone Pt Rd, near Balancing Rock, MDSP, 6.3 mi NE of San Ramon, 1877 ft, Mar 2017, *Hutton 473C* (CAS).

Didymodon nicholsonii Culm. (Pottiaceae)

Uncommon. On boulders or soil over rock in intermittent streamlets or forest.

Rock City region, along Summit Trail near campgrounds, [MDSP], 1650 ft, Jan 2004, *Shevock 24540* (CAS); along trail to Mt. Olympia, northern flank of North Peak, [MDSP], 1550 ft, Feb 2004, *Shevock 24578* (CAS); in West Fork Sycamore Canyon along trail to Lower Rock City, [MDSP], 1969 ft, Dec 2000, *Norris 100485* (UC).

Didymodon norrisii R.H.Zander (Pottiaceae)

Common. On rock in mixed woodland.

Pine Canyon along trail to Castle Rocks, [CRRRA], 650 ft, Feb 2001, *Shevock 20347* (CAS); along North Peak Trail between Devil's Elbow and Prospectors Gap, [MDSP], 3150 ft, Jan 2004, *Shevock 24556* (CAS); along North Gate Rd 0.4 mi above Oak Knoll Picnic Area, [MDSP], 2800 ft, Jan 2004, *Shevock 24504* (CAS); Donner Canyon, trail to the waterfalls below Mt. Diablo Peak in Wild Oat Canyon area, MDSP, 1650 ft, Feb 2004, *Shevock 24626* (CAS); along trail to Mt. Olympia, northern flank of North Peak, [MDSP], 1800 ft, Feb 2004, *Shevock 24588* (CAS).

Didymodon rigidulus Hedw. (Pottiaceae)

Rare. Without habitat information.

Rock City, [MDSP], Nov 2014, *Tan 2014-300* (UC). A second specimen identified on the packet as *Didymodon rigidulus?* is: On rocks, Mt. Diablo, Apr 1923, *Eastwood 139a* (ILL). We have not seen this specimen and the identification is not confirmed.

Didymodon tophaceus (Brid.) Lisa (Pottiaceae)
Abundant. On shady rocks and moist soil.
Long Ridge above North Gate, MDSP, 980 ft, Jan 2004, *Shevock 24497* (CAS); southeastern-most waterfall area on Falls Trail, Donner Canyon, [MDSP], Mar 2003, *Game 03/018B* (UC); on concrete dam spillway at Pine Pond, on Stage Rd, Pine Canyon, 3.8 mi NE of Danville [MDSP], 620 ft, Aug 2014, *Hutton 22* (CAS); off of trail to Mt. Olympia, northern flank of North Peak, [MDSP], 2035 ft, Feb 2004, *Shevock 24611* (CAS); John Ginochio's Arroyo Del Cerro [on private property, 1.87 mi ESE of North Gate Rd entrance to MDSP], 1215 ft, Apr 2018, *Ludwig 609, 610* (CAS).

Didymodon vinealis (Brid.) R.H.Zander (Pottiaceae)
Abundant. On rock, soil or wood in sun or partial shade.
At Morgan Sulfur Spring, on side trail off Clark Canyon trail, off Curry Canyon Rd, on private property surrounded by MDSP, 6.6 mi SE of Clayton, 1252 ft, Jan 2017, *Hutton 434B* (CAS); along Red Rd in White Canyon, off Mitchell Canyon Rd, Mitchell Canyon, MDSP, 2.5 mi SW of Clayton, 804 ft, Jan 2017, *Hutton 427A* (CAS); along Trail Through Time, Rock City, MDSP, 4.3 mi NE of Danville, 1501 ft, Jun 2016, *Hutton 381B* (CAS); along trail to Mt. Olympia, northern flank of North Peak, 1950 ft, Feb 2004, *Shevock 24593* (CAS); John Ginochio's Arroyo Del Cerro [on private property 1.9 mi ESE of North Gate Rd entrance to MDSP], 1214 ft, Apr 2018, *Ludwig 608* (CAS).

Ditrichum schimperi (Lesq.) Kuntze (Ditrichaceae)
Rare. On soil bank.
Rock City, half way [along] Trail Through Time, [MDSP], Jun 2016, *Tan s.n.* (UC).

Encalypta vulgaris Hedw. (Encalyptaceae)
Uncommon. On rock.
Mitchell's Canyon, Mt. Diablo, [MDSP], California, Feb 1896, *Howe 397* (CAS); Donner Canyon, trail to waterfalls below Mt. Diablo Peak in Wild Oat Canyon area, [MDSP], 1650 ft, Feb 2004, *Shevock 24623* (UC).

Epipterygium tozeri (Grev.) Lindb. (Mielichhoferiaceae)
Uncommon. On moist soil or soil over rock, in filtered light or shade.
On bank to right of deserted cabin on Sulfur Spring Trail at sulfur spring and junction with spur trail, Morgan Territory Regional Preserve, 8.1 mi NE of San Ramon, 1013 ft, Feb 2017, *Hutton 455H* (CAS); Trail Through Time, [Rock City, MDSP], 1510 ft, Jun 2016, *Ludwig 131A* (CAS).

Eucladium verticillatum (With.) Bruch & Schimp. (Pottiaceae)
Common. On wet soil or rock in shade or partial shade.
From the southeastern-most waterfall area, on Falls Trail, Donner Canyon region, Mt. Diablo, [MDSP],

Mar 2003, *Game 03/018A* (UC); along Stage Rd at border of Diablo Foothills Regional Park and MDSP, Pine Canyon, 3.2 mi NE of Alamo, 398 ft, Jul 2014, *Hutton 10* (CAS); Mitchell's Canyon, Mt. Diablo, Feb 1896, *Howe s.n.* (CAS, UBC); at bottom of Mitchell Canyon, Mt. Diablo, Oct 1950, *Koch 3323* (UC); on John Ginochio's property on the east side of North Gate Rd [3 mi SE of North Gate Rd entrance to MDSP], Apr 2018, 1242 ft, *Ludwig 613* (CAS).

Fabronia pusilla Raddi (Fabroniaceae)
Common. On tree bark in filtered light or shade or sometimes soil or rock.
Dan Cook Canyon, [MDSP], Oct 2015, *Tan s.n.* (UC); Donner Canyon, off of Falls Trail above junction with Middle Trail, [MDSP], 1500 ft, Jan 2001, *Shevock 20334* (CAS); along Summit Trail in Dan Cook Canyon, bordering MDSP, 3.2 mi NE of Danville, 770 ft, Oct 2015, *Hutton 245* (CAS); along Back Creek Trail in MDSP near Clayton, 820 ft, Mar 2007, *Norris 109852* (UC); Mitchell's Canyon, Mt. Diablo [MDSP], Feb 1896, *Howe s.n.* (NY).

Fissidens bryoides Hedw. (Fissidentaceae)
Common. Moist to wet soil in shade or filtered light.
Donner Canyon, [MDSP], Mar 2015, *Tan 2015-119* (UC); adjacent to Mitchell Canyon trailhead parking area, MDSP, 1.5 mi S of Clayton, 573 ft, Jan 2017, *Hutton 423A* (CAS); on Sulfur Spring Trail at sulfur spring and junction with spur trail, Morgan Territory Regional Preserve, 8 mi NE of San Ramon, 1013 ft, Feb 2017, *Hutton 457C* (CAS); Rock City Region, Blackhawk Fire Rd above junction with Trail Through Time and Forks of Sycamore Creek, [MDSP], 1300 ft, Jan 2004, *Shevock 24537* (CAS); in Lime Ridge County Reserve near NW corner of MDSP, 984 ft, Apr 2001, *Norris 101318* (UC).

Fissidens crispus Mont. (Fissidentaceae)
Abundant. Moist to wet soil or rock in shade.
Along Mary Bowerman Trail, at summit of Mt. Diablo, MDSP, 4.2 mi SE of Clayton, 3742 ft, Feb 2017, *Hutton 446* (CAS); at Coffeeberry Spring, along Burma Rd to Long Ridge, MDSP, 4.7 mi NE of Danville, 1458 ft, Oct 2015, *Hutton 265C* (CAS); along Donner Canyon Rd, in Donner Canyon, MDSP, 2.1 mi SE of Clayton, 722 ft, Mar 2015, *Hutton 106D.1* (CAS); along trail to Frog Pond where stream crosses trail, 1553 ft, [MDSP], Jun 2015, *Ludwig 69* (CAS); Mt. Diablo Cañon, Feb 1896, *Howe s.n.* (NY, PH) [as *F. limbatus* Sull.].

Fissidens curvatus Hornsch. (Fissidentaceae)
Uncommon. On soil in woodland.
Donner Canyon, [MDSP], Mar 2015, *Tan 2015-126* (UC); Pine Canyon along road below Castle Rocks (Sunset Trail) at Castle Rocks [Regional] Recreation Area, 480 ft, Feb 2001, *Shevock 20362* (CAS).

Fissidens sublimbatus Grout (Fissidentaceae)
Common. On moist diffusely lit soils.

Along North Gate Rd 0.4 mi above Oak Knoll Picnic Area, [MDSP], 2800 ft, Jan 2004, *Shevock 24508* (CAS); John Ginocchio's Arroyo Del Cerro [on private property 1.84 mi ESE of North Gate Rd entrance to MDSP], 1207 ft, Apr 2018, *Ludwig 612* (CAS); in Lime Ridge County Reserve near NW corner of MDSP, 984 ft, Apr 2001, *Norris 101361* (UC); along White Canyon at Red Rd, near end of Mitchell Canyon Rd in MDSP, S of Clayton, 820 ft, Dec 2000, *Norris 100580* (UC); Donner Canyon, trail to the waterfalls below Mt. Diablo Peak, [MDSP], 815 ft, Feb 2004, *Shevock 24617* (CAS, UC).

***Funaria hygrometrica* Hedw. (Funariaceae)**

Abundant. On moist soils in sun to shade.

Donner Canyon, [MDSP], Mar 2015, *Tan 2015-127* (UC); Prospector's Gap: junction of North Peak Trail and North Peak Rd, [MDSP], 3014 ft, May 2015, *Ludwig 63A* (CAS); at streamlet crossing, along trail to south of Mt. Diablo Mine and to N of Perkins Canyon, MDSP, 4.4 mi SE of Clayton, 794 ft, Apr 2016, *Hutton 347B* (CAS); Pine Canyon along road below Castle Rocks (Sunset Trail) at Castle Rocks [Regional] Recreation Area, 480 ft, Feb 2001, *Shevock 20364* (CAS); along Knobcone Point Rd to Balancing Rock, MDSP, 5.8 mi NE of San Ramon, 1659 ft, Mar 2017, *Hutton 465* (CAS).

***Funaria muhlenbergii* Turner (Funariaceae)**

Uncommon. Soil over rock in woodland or diffuse light.

Donner Canyon, trail to the waterfalls below Mt. Diablo Peak in Wild Oat Canyon area, [MDSP], 1650 ft, Feb 2004, *Shevock 24624* (CAS); on a bank in Mitchell Canyon, MDSP, 712 ft, Apr 2019 *Game 19/018* (UC).

***Gemmabryum caespiticium* (Hedw.) J.R.Spence (Bryaceae)**

Rare. On moist soil over rock, in filtered light.

On bank to right of deserted cabin, on Sulfur Spring Trail at sulfur spring and junction with spur trail, Morgan Territory Regional Preserve, 8 mi NE of San Ramon, 1013 ft, Feb 2017, *Hutton 455A* (CAS).

***Gemmabryum gemmilucens* (R.Wilczek & Demaret) J.R.Spence (Bryaceae)**

Common. On mud, clay or rock, in the open or in shade.

On a side spur trail off Sulfur Spring Trail, Morgan Territory Regional Preserve, close to border with private property, 7.7 mi NE of San Ramon, 950 ft, Feb 2017, *Hutton 459B* (CAS); Mitchell Canyon, trailhead parking area [MDSP], Mar 2016, *Hutton 338* (UC); at Coffeeberry Spring, adjacent to trail, along Burma Rd to Long Ridge, MDSP, 4.5 mi NE of Danville, 1458 ft, Oct 2015, *Hutton 265A* (CAS); near the lower parking lot at Mitchell Canyon, [MDSP], Apr 2016, *Game 16/038* (UC).

***Gemmabryum valparaisense* (Thér.) J.R.Spence (Bryaceae)**

Rare. On moist soil, in full shade, on roadside bank in riparian woodland.

On Finley Rd on private property bordering Morgan Territory Regional Preserve, 5 mi NE of San Ramon, 900 ft, Feb 2017, *Hutton 462B* (CAS).

***Gemmabryum vinosum* J.R.Spence & Kellman (Bryaceae)**

Rare. On large metamorphic boulders and rock outcrops in woodland.

Below observation deck of Mt. Diablo Peak, 3800 ft, Feb 2004, *Shevock 24635* (CAS).

***Grimmia alpestris* (F.Weber & D.Mohr) Schleich. (Grimmiaceae)**

Common. On rock outcrops in full sun to partial shade.

Along North Peak Rd to North Peak close to Prospector's Gap, MDSP, 3.9 mi SE of Clayton, 3067 ft, May 2015, *Hutton 156* (CAS); adjacent to trail, along Mary Bowerman Trail, at summit of Mt. Diablo, MDSP, 4.3 mi SE of Clayton, 3693 ft, Feb 2017, *Hutton 449A* (CAS); near top of Mt. Diablo, E or N of summit, Feb 2004, *Game 04/005F* (UC); at Devil's Elbow near top of Mt. Diablo, MDSP, Dec 2000 *Norris 100564* (UC).

***Grimmia anodon* Bruch & Schimp. (Grimmiaceae)**

Uncommon. On large boulders or rock outcrops in woodland.

Below summit below observation deck of Mt. Diablo Peak, [MDSP], 3800 ft, Feb 2004, *Shevock 24631* (CAS); summit area northeast of lookout [MDSP], 3806 ft, Oct 2006, *Toren 9500* (CAS).

***Grimmia laevigata* (Brid.) Brid. (Grimmiaceae)**

Abundant. On dry exposed rocks outcrops and boulders, usually brightly lit.

At end of China Wall Rd, at China Wall rock outcrop, MDSP, 2.6 mi NE of Alamo, 824 ft, Aug 2016, *Hutton 403B* (CAS); below Observation Deck at summit of Mt. Diablo, MDSP, 4.2 mi SE of Clayton, 3800 ft, Nov 2015, *Hutton 278B* (CAS); alongside trail, long trail between Mt. Diablo Mine and Perkins Canyon, MDSP, Perkins Canyon, 4.1 mi SE of Clayton, 1072 ft, Apr 2016, *Hutton 339B* (CAS); along Deer Flat Rd, from Juniper Campground, 150 yds from junction with Burma Rd, [MDSP] 4 mi S of Clayton, 2821 ft, Jan 2015, *Hutton 78* (CAS); Falls Trail region of Donner Canyon, MDSP, March 2003, *Game 03/019* (UC).

***Grimmia leibergii* Paris (Grimmiaceae)**

Common. On rock outcrops or thin soil over rock in full sun to diffuse shade. South of Briones-Mt. Diablo Trail at China Wall, MDSP, 984 ft, Apr 2001, *Norris 101418* (UC); along Coulter Pine Trail, between Mitchell Canyon Trailhead and Back Canyon, MDSP, 1.7 mi S of Clayton, 802 ft, Mar 2016, *Hutton 323* (CAS); at the lower end of Bald Ridge Trail near Murchio Gap, Jun 2004, *Game 04/052* (UC); near Rock City, MDSP, Feb 2004, *Game*

04/003A (UC); at the head of Mitchell Canyon, Mt. Diablo [MDSP], Oct 1950, *Koch 3341* (UC).

Grimmia lisae DeNot. (Grimmiaceae)

Abundant. On dry rock outcrops or soil in full sun or partial shade.

Along Bald Ridge Trail, near junction with North Peak Rd at Prospector's Gap, MDSP, 4 mi SE of Clayton, 2987 ft, Apr 2017, *Hutton 524B* (CAS); at Morgan Sulfur Spring, on side trail off Clark Canyon trail, off Curry Canyon Rd, on private property surrounded by MDSP, 8.3 mi NE of San Ramon, 1252 ft, Jan 2017, *Hutton 435C* (CAS); on Eagle Peak Trail at junction with Meridian Ridge Rd, Murchio Gap, MDSP, 3.2 mi S of Clayton, 2330 ft, Mar 2016, *Hutton 336A* (CAS); along Burma Rd to Long Ridge, MDSP, 4.6 mi NE of Danville, 1454 ft, Oct 2015, *Hutton 263C* (CAS); Rock City, MDSP, Feb 2004, *Game 04/003* (UC).

Grimmia mariniana Sayre (Grimmiaceae)

Uncommon. On rock outcrop, in oak savannah.

Along North Peak Rd to North Peak close to Prospector's Gap, MDSP, 3.9 mi SE of Clayton, 3069 ft, Feb 2015, *Hutton 95B* (CAS); N slope of Mt. Diablo below summit [MDSP], 6 mi NE of Danville, 3800 ft, Jun 1962, *Hermann 17360* (CAS).

Grimmia montana Bruch & Schimp. (Grimmiaceae)

Common. On rock, among oak and chaparral.

Along Mary Bowerman Trail, at summit of Mt. Diablo, MDSP, 4.3 mi SE of Clayton, 3693 ft, Feb 2017, *Hutton 448* (CAS); along North Peak Rd to North Peak close to Prospector's Gap, MDSP, 3.9 mi SE of Clayton, 3068 ft, Feb 2015, *Hutton 95C* (CAS); along Green Ranch Rd, MDSP, 5.6 mi NE of Danville, 2850 ft, Apr 2016, *Hutton 359C* (CAS); along Bald Ridge Trail, approx 0.5 mi from Murchio Gap, MDSP, 3.6 mi SE of Clayton, 2679 ft, Apr 2017, *Hutton 522* (CAS); on rocks near the summit of Mt. Diablo, MDSP, Feb. 2004, *Game 04/005E* (UC).

Grimmia ovalis (Hedw.) Lindb. (Grimmiaceae)

Common. On exposed rock in mixed oak and juniper woodland.

Below Observation Deck at Mt. Diablo summit, MDSP, 4.3 mi SE of Clayton, 3800 ft, Nov 2015, *Hutton 278A* (CAS); along North Gate Rd 0.4 mi above Oak Knoll Picnic Area, [MDSP], 2800 ft, Jan 2004, *Shevock 24505A* (CAS); rocky point along Devil's Elbow section of the North Peak Trail below Devil's Pulpit, [MDSP], 3400 ft, Jan 2004, *Shevock 24547* (CAS); on rocky ridge adjacent to road between Prospectors Gap and the summit of North Peak, [MDSP], 3025 ft, Jan 2004, *Shevock 24562A* (CAS); summit area NE of lookout, [MDSP], 3806 ft, Oct 2006, *Toren 9499* (CAS).

Grimmia pulvinata (Hedw.) Sm. (Grimmiaceae)

Abundant. On exposed rock, in mixed oak woodland and chaparral.

At edge of lower parking area at summit of Mt. Diablo, MDSP, 4.3 mi S of Clayton, 3670 ft, Feb

2017, *Hutton 451A* (CAS); along Deer Flat Rd from Juniper Campground, near junction with Burma Rd, MDSP, 5.3 mi NE of Danville, 2780 ft, Feb 2016, *Hutton 289A* (CAS); Bald Ridge Trail, top of pass, [near Prospectors Gap, MDSP], 2674 ft, Apr 2017, *Ludwig 229* (CAS); along Green Ranch Rd, MDSP, 5.49 mi NE of Danville, 2684 ft, Jan 2020, *Hutton 627* (CAS); Back Canyon, MDSP, ~1400 ft, Jun 2014, *Game 04/049B* (UC).

Grimmia torenii Hastings (Grimmiaceae)

Uncommon. On exposed rock, in mixed oak/juniper woodland.

Adjacent to road between Prospectors Gap and the summit of North Peak, 3025 ft, Jan 2004, *Shevock 24562* (CAS); summit area NE of [summit] lookout [MDSP], 3806 ft, Oct 2006, *Toren 9498* (CAS).

Grimmia trichophylla Grev. (Grimmiaceae)

Abundant. On exposed rock, in chaparral and mixed woodland.

Along Bald Ridge Trail, between Prospectors Gap and Murchio Gap, MDSP, 3.5 mi S of Clayton, 2674 ft, Apr 2017, *Hutton 523A* (CAS); along Mary Bowerman Trail, at summit of Mt. Diablo, MDSP, 4.3 mi SE of Clayton, 3734 ft, Feb 2017, *Hutton 444A* (CAS); Mitchell Canyon, MDSP, Feb. 2010, *Game 10/001* (UC); along Trail Through Time, near junction with Devil's Slide Trail, Rock City [MDSP], 5.3 mi NE of San Ramon, 1383 ft, Jun 2015, *Hutton 184A* (CAS); northeast corner of John Ginochio's property on the east side of North Gate Rd [1.94 mi ESE of North Gate Rd Entrance to MDSP], 1214 ft, Apr 2018, *Ludwig 607* (CAS).

Gymnostomum calcareum Nees & Hornsch. (Pottiaceae)

Common. On rock outcrops, in mixed hardwood woodland.

In Lime Ridge County Reserve near NW corner of MDSP, 984 ft, Apr 2001, *Norris 101374* (UC); off of Falls Trail [Donner Canyon] above junction with Middle Trail, MDSP, 1500 ft, Jan 2001, *Shevock 20333* (CAS); at summit ridge of Mt. Olympia, northern flank of North Peak, MDSP, 2870 ft, Feb 2004, *Shevock 24605* (UC); Donner Canyon, above Falls Trail in Wild Oat Canyon tributary below North Peak, MDSP, 1900 ft, Jan 2001, *Shevock 20342* (CAS); at Devil's Elbow near top of Mt. Diablo, MDSP, 3280 ft, Dec 2000, *Norris 100569A* (CAS).

Gymnostomum viridulum Brid. (Pottiaceae)

Uncommon. On rock and soil, in mixed woodland.

Rock City region, along Summit Trail near campgrounds, [MDSP], 1650 ft, Jan 2004, *Shevock 24541* (CAS); at Devil's Elbow near top of Mt. Diablo, MDSP, 3281 ft, Dec 2000, *Norris 100569* (UC) [listed in Consortium of North American Bryophyte Herbaria database as *G. calcareum* (CAS) or *G. aeruginosum* Sm. (UC)].

Hedwigia detonsa (M.Howe) W.R.Buck & D.H.Norris (Hedwigiaceae)

Common. On exposed rock in chaparral and mixed oak woodland.

On Eagle Peak Trail at junction with Meridian Ridge Rd, Murchio Gap, MDSP, 3.2 mi S of Clayton, 2330 ft, Mar 2016, *Hutton 335D* (CAS); along Mary Bowerman Trail, at summit of Mt. Diablo, MDSP, 4.3 mi SE of Clayton, 3712 ft, Jan 2015, *Hutton 68* (CAS); along trail to Mt. Olympia, northern flank of North Peak, 2750 ft, Feb 2004, *Shevock 24601* (CAS); along North Peak Trail between Devil's Elbow and Prospectors Gap, [MDSP], 3475 ft, Jan 2004, *Shevock 24548* (CAS); along Green Ranch Rd, MDSP, 5.49 mi NE of Danville, 2684 ft, Jan 2020, *Hutton 626C* (CAS).

Hedwigia stellata Hedenäs (Hedwigiaceae)

Common. On rock, among mixed oak woodland and chaparral.

On ridge of Pine Canyon along trail at Castle Rocks [CRRRA], 800 ft, Feb 2001, *Shevock 20354* (CAS); along North Gate Rd 0.4 mi above Oak Knoll Picnic Area, [MDSP], 2800 ft, Jan 2004, *Shevock 24506* (CAS); along West Fork Sycamore Canyon near trail from Lower Rock City, [MDSP], 1969 ft, Dec 2000, *Norris 100547* (UC); on N-facing slopes of Mt. Diablo at Mount Diablo Fire Interpretive Trail around summit of Mt. Diablo, MDSP, 3773 ft, Jan 2007, *Norris 109567* (UC); near the top end of Bald Ridge Trail, MDSP, Jun 2004, *Game 04/050A* (UC).

Hennediella stanfordensis (Steere) Blockeel (Pottiaceae)

Abundant. On shaded soil and road cut, among mixed woodland and chaparral.

On Finley Rd on private property bordering Morgan Territory Regional Preserve, 5 mi NE of San Ramon, 900 ft, Feb 2017, *Hutton 462A* (CAS); along trail through Back Canyon, MDSP, 2.6 mi S of Clayton, 1304 ft, Mar 2016, *Hutton 330A* (CAS); Donner Canyon, along Donner Canyon Rd near junction with Hetherington Trail, [MDSP], 1000 ft, Jan 2001, *Shevock 20310* (CAS); along Mitchell Canyon Trail, at junction with Red Rd, MDSP, 2.4 mi SW of Clayton, 765 ft, Jan 2017, *Hutton 425A.1* (CAS); on E-side of North Gate Rd, NE corner of John Ginochio's Arroyo Del Cerro [private property, 1.9 mi ESE of North Gate Rd Entrance to MDSP], 1202 ft, *Ludwig 600* (CAS).

Homalothecium arenarium (Lesq.) E.Lawton (Brachytheciaceae)

Common. On rock and soil, in mixed hardwood woodland.

Mitchell Canyon, [MDSP], Feb 2015, *Tan 2015-138* (UC); along West Fork Sycamore Canyon near trail from Lower Rock City, 1969 ft, Dec 2000, *Norris 100503* (UC); in Lime Ridge County Reserve near NW corner of MDSP, 984 ft, Apr 2001, *Norris 101370* (UC); along trail between Mt. Diablo Mine and Perkins Canyon, MDSP, 3.6 mi SE of Clayton,

1094 ft, Apr 2016, *Hutton 340D* (CAS); Perkins Canyon [MDSP] Apr 2016 *Tan s.n.* (UC).

Homalothecium nevadense (Lesq.) Renauld & Cardot (Brachytheciaceae)

Rare. On exposed rock in oak savannah grassland. Mt. Diablo, Apr 1923, *Eastwood 149A* (CAS).

Homalothecium nuttallii (Wilson) A.Jaeger (Brachytheciaceae)

Abundant. On tree bark, in mixed hardwood woodland.

Along Red Rd, 250 yds from junction with Mitchell Canyon Trail, MDSP, 2.5 mi SW of Clayton, 811 ft, Jan 2017, *Hutton 428A* (CAS); Donner Canyon, along Falls Trail above junction with Middle Trail, 1500 ft, Jan 2001, *Shevock 20328* (CAS); on N-facing slopes of Pine Ridge above Pine Pond in MDSP, 623 ft, Feb 2001, *Norris 100740* (UC); Dan Cook Canyon along trail, [MDSP], 782 ft, Oct 2015, *Ludwig 98* (CAS); Trail Through Time [Rock City, MDSP], 1439 ft, Jun 2016, *Ludwig 123* (CAS).

Homalothecium pinnatifidum (Sull. & Lesq.) E.Lawton (Brachytheciaceae)

Homalothecium aureum (Spruce) H. Rob.

Abundant. On tree bark and soil, in mixed woodland.

Along Trail Through Time, Rock City, MDSP, 4.5 mi NE of Danville, 1501 ft, Jun 2016, *Hutton 380A* (CAS); at end of China Wall Rd, at China Wall rock outcrop, MDSP, 2.6 mi NE of Alamo, 932 ft, Aug 2016, *Hutton 410* (CAS); at Morgan Sulfur Spring, on side trail off Clark Canyon Trail, off Curry Canyon Rd, on private property surrounded by MDSP, 8.3 mi NE of San Ramon, 1252 ft, Jan 2017, *Hutton 436* (CAS); Mitchell Canyon trailside, 572 ft, Jan 2015, *Ludwig 11* (CAS); Donner Canyon trailside, 730 ft, Apr 2015, *Ludwig 44* (CAS).

Hygroamblystegium varium (Hedw.) Mönk. (Amblystegiaceae)

Uncommon. On wet pebble on streambank.

Curry Canyon, along Frog Pond Trail, [MDSP], *Tan 2015-125* (UC); Mitchell Canyon, Mt. Diablo, Oct 1950, *Koch 3323a* (ISC) [as *Hygroamblystegium tenax* (Hedw.) Jenn.].

Imbribryum gemmiparum (DeNot.) J.R.Spence (Bryaceae)

Rare. In rocky country, east-facing.

In Back Canyon, uphill west of trail, ~1500 ft, Jan 2006, *Game 06/002A* (UC).

Imbribryum miniatum (Lesq.) J.R.Spence. (Bryaceae)

Uncommon. On rock, beside creek in mixed riparian woodland.

Donner Canyon, [MDSP], Mar 2015, *Tan 2015-106* (UC); along Donner Canyon Rd, Donner Canyon, MDSP, 2.1 mi SE of Clayton, 722 ft, Mar 2015, *Hutton 106C* (CAS); Donner Canyon, off of Falls Trail above waterfall area, [MDSP], 1800 ft, Jan 2001, *Shevock 20340* (CAS).

Imbriobryum torenii J.R.Spence & Shevock. (Bryaceae)

Uncommon. On exposed rock outcrops, in oak woodland.

Along North Peak Trail between Devil's Elbow and Prospector's Gap, MDSP, 3150 ft, Jan 2004, *Shevock 24557* (CAS); along trail to Mt. Olympia, northern flank of North Peak, MDSP, 1801 ft, Jan 2004, *Shevock 24587* (CAS); on trail to Mt. Olympia, northern flank of North Peak, MDSP, 1950 ft, Feb 2004, *Shevock 24615* (CAS).

Isothecium cristatum (Hampe) H.Rob. (Lembophyllaceae)

Common. On rock, dead wood and soil, in mixed woodland.

Rock City, Trail Through Time, [MDSP], Jun 2016, *Tan s.n.* (UC); adjacent to Mitchell Canyon trailhead parking area, MDSP, 1.4 mi S of Clayton, 557 ft, Jan 2017, *Hutton 422C* (CAS); Pine Canyon along trail below Castle Rocks to road (Sunset Trail), [CRRRA], 700 ft, Feb 2001, *Shevock 20356* (CAS, UC); along Trail Through Time, Rock City, MDSP, 4.2 mi NE of Danville, 1501 ft, Jun 2016, *Hutton 381A* (CAS); up-slope from road, 1.5 mi into MDSP from the entrance, May 1947, *Koch 1560* (MICH).

Isothecium stoloniferum Brid. (Lembophyllaceae)

Uncommon. On rock in mixed hardwood woodland. Dan Cook Canyon, [MDSP], Oct 2015, *Tan s.n.* (UC); Rock City region, along Summit Trail near campgrounds, [MDSP], 1650 ft, Jan 2004, *Shevock 24542* (CAS).

Kindbergia Ochyra sp. (Brachytheciaceae)

Rare. Under manzanita in grassy sod on slope.

Head of Mitchell Canyon, Mount Diablo, Oct 1950, *Koch 3316a* (ILL) [as *Eurhynchium* Bruch & Schimp., sp.].

We have not seen this specimen. Two *Kindbergia* species are reported from elsewhere in Contra Costa County: *K. oregana* (Sull.) Ochyra and *K. praelonga* (Hedw.) Ochyra. The Mount Diablo specimen is most likely to be *K. praelonga* since this is by far the most common in the county and *K. oregana* tends to be more coastal or in more mesic forest environments.

Leptodictyum riparium (Hedw.) Warnst. (Amblystegiaceae)

Rare. Moist shaded soil over rock at edge of seasonal streamlet.

Along Green Ranch Rd, MDSP, 5.52 mi NE of Danville, 2661 ft, Jan 2020, *Hutton 617, 620A* (CAS).

Lewinskya bolanderi (Sull.) F.Lara, Garilleti & Goffinet (Orthotrichaceae)

Orthotrichum bolanderi Sull.

Uncommon. On shaded rock, in mixed woodland.

Frog Pond Rd, May 2015, *Tan 2015-143* (UC); at Devil's Elbow near top of Mt. Diablo, [MDSP], 3281 ft, Dec 2000, *Norris 100559* (UC); Donner Canyon,

trail to the waterfalls below Mt. Diablo Peak, [MDSP], 1200 ft, Feb 2004, *Shevock 24630* (CAS).

Lewinskya rupestris (Schleich. ex Schwägr.) F.Lara, Garilleti & Goffinet (Orthotrichaceae).

Orthotrichum rupestre Schleich. ex Schwägr.

Abundant. On rock and occasionally tree bark, in mixed chaparral and oak woodland.

On N-facing slopes of Mt. Diablo at Mt. Diablo Fire Interpretive Trail [Mary Bowerman Interpretive Trail] around summit of Mt. Diablo, [MDSP], 3773 ft, Jan 2007, *Norris 109572* (UC); along North Gate Rd at Blue Oak Picnic Area, [MDSP], 2625 ft, Jan 2001, *Shevock 24511* (CAS); below observation deck of Mt. Diablo Peak, [MDSP], 3800 ft, Feb 2004, *Shevock 24632A* (CAS); North Peak Trail, [MDSP], Feb 2015, *Tan 2015-148* (UC); South Peak, Mt. Diablo, 3700 ft, Mar 1953, *Howell 153* (CAS).

Lewinskya shawii (Wilson) F.Lara, Garilleti & Goffinet (Orthotrichaceae)

Orthotrichum shawii Wilson

Rare. On exposed rock, in mixed oak woodland.

Below observation deck of Mt. Diablo Peak, [MDSP], 3800 ft, Feb 2004, *Shevock 24632* (CAS).

Lewinskya speciosa (Nees) F.Lara, Garilleti & Goffinet (Orthotrichaceae)

Rare. No habitat information.

Mt. Diablo, Feb 1896, *Howe s.n.* (NY) [as *Lewinskya speciosa* var. *killiasii* (Nees) ined.].

Neckera menziesii Drumm. (Neckeraceae).

Rare. No habitat information.

Mitchell's Cañon, Mt. Diablo, Feb. 1896 *Howe s.n.* (NY) [as *Metaneckera menziesii* (Drumm.) Steere].

Nogopterium gracile (Hedw.) Crosby & W.R.Buck (Leucodontaceae)

Abundant. On tree bark and rock, in mixed riparian woodland.

Along Stage Rd in Pine Canyon near junction with Buckeye Ravine Trail, Diablo Foothills Regional Park, 3 mi NE of Alamo, 500 ft, Jul 2014, *Hutton 13A* (CAS); along Sulfur Spring Trail adjacent to sulfur spring, Morgan Territory Regional Preserve, 7.8 mi NE of San Ramon, 1032 ft, Feb 2017, *Hutton 454* (CAS); in Juniper Campground, MDSP, 4.4 mi S of Clayton, 2975 ft, Jan 2015, *Hutton 75* (CAS); along Frog Pond Rd at Mountain Spring Creek crossing, MDSP, 6.6 mi NE of San Ramon, 1552 ft, Jun 2015, *Hutton 167A* (CAS); Donner Canyon, along Falls Trail above junction with Middle Trail, [MDSP], 1500 ft, Jan 2001, *Shevock 20330* (UC).

Orthotrichum cucullatum F.Lara, R.Medina & Garilleti (Orthotrichaceae)

Common. On tree bark, in mixed oak/pine woodland.

Along Three Springs Trail immediately SW of Rhyne Mine in MDSP, 1558 ft, Feb 2001, *Norris 100806, 100808* (UC); in filtered light, beside rock outcrop, China Wall, MDSP, 946 ft, Aug 2016, *Hutton 412E*

(CAS); Mitchell Canyon, Mt. Diablo, Feb 2015, *Tan 2015-152* (UC); Dan Cook Canyon, Oct 2015, *Tan s.n.* (UC); Arroyo Del Cerro (private property within MDSP), 1231 ft, Apr 2018, *Ludwig 616* (CAS).

Orthotrichum cylindrocarpum Lesq. (Orthotrichaceae)

Orthotrichum tenellum Bruch ex Brid., misapplied
Common. On tree bark, in mixed oak woodland.
Along White Canyon at Red Rd near end of Mitchell Canyon Rd in MDSP S of Clayton, [MDSP], 820 ft, Dec 2000, *Norris 100574* (UC); Dan Cook Canyon, MDSP, 967 ft, Oct 2015, *Hutton 252B* (CAS); North Peak Trail, [MDSP], Feb 2015, *Tan 2015-151* (UC); down the trail from Rock City, Mount Diablo, [MDSP], Feb 2004, *Game 04/002* (UC); Long Ridge above North Gate Rd, [MDSP] 980 ft, Jan 2004, with Chris Thayer & Heath Bartosh, *Shevock 24500* (CAS).

Medina et al. (2019) have shown that the name *Orthotrichum cylindrocarpum* Lesq. has priority over *O. coulteri* Mitt., which has also been applied to this taxon.

Orthotrichum franciscanum F.Lara, R.Medina & Garilleti (Orthotrichaceae)

Uncommon. On tree bark, in mixed riparian woodland.

Donner Canyon, MDSP, 711 ft, Mar 2015, *Hutton 108* (CAS); Mitchell Canyon, Mt. Diablo, [MDSP], Feb 2015, *Tan 2015-152* (UC); Dan Cook Canyon, [MDSP], Oct 2015, *Tan s.n.* (UC).

Orthotrichum norrisii F.Lara, R.Medina & Garilleti (Orthotrichaceae)

Common. On tree bark, in mixed riparian woodland.
Green Ranch Rd, [MDSP], Apr 2016, *Tan s.n.* (UC); along upper reaches of Mitchell Canyon Rd, MDSP, 3.2 mi S of Clayton, 1107 ft, Aug 2015, *Hutton 204* (CAS); Donner Canyon, [MDSP], Mar 2015, *Tan 2015-150* (UC); along White Canyon at Red Rd near end of Mitchell Canyon Rd in MDSP, S of Clayton, 820 ft, Dec 2000, *Norris 100574* (UC).

Orthotrichum pumilum Sw. (Orthotrichaceae)

Rare. On moist, diffusely lit bark of *Aesculus californica* in mixed forest.

On north-facing slopes of Pine Ridge above Pine Pond in MDSP, 623 ft, Feb 2001, *Norris 100750* (UC).

Orthotrichum rivulare Turner (Orthotrichaceae)

Rare. On shaded rock in intermittent creek bed in mixed riparian woodland.

Just below forks of Sycamore Creek, Rock City region, Junction of Trail Through Time with Sycamore Fire Rd, [MDSP], 1099 ft, Jan 2004, *Shevock 24525* (CAS).

Plagiomnium venustum (Mitt.) T.J.Kop. (Mniaceae)

Common. On rock in intermittent streamlet, in mixed riparian woodland.

Donner Canyon, along Falls Trail above junction with Middle Trail, [MDSP], 1500 ft, Jan 2001, *Shevock 20329* (CAS); western part of Falls Trail, Donner Canyon, Mar 2003, *Game 03/020* (UC); Mitchell's Canyon, Mt. Diablo [MDSP], Feb 1896, *Howe s.n.* (NY); along Falls Trail at Junction with Middle Trail [Donner Canyon, MDSP], Sep 2003, *Harris 655* (UC).

Plagiothecium pacificum J.T.Wynns (Plagiotheciaceae)

Rare. On shaded soil, in mixed riparian woodland.
Trail Through Time, [Rock City, MDSP], 1510 ft, Jun 2016, *Ludwig 131B* (CAS).

Pleuridium acuminatum Lindb. (Ditrichaceae)

Common. On soil, in mixed woodland.

Along Knobcone Point Rd, close to Curry Point, MDSP, 4.4 mi NE of Danville, 1759 ft, Mar 2016, *Hutton 293E* (CAS); along Knobcone Point Rd to Balancing Rock, MDSP, 5.9 mi NE of San Ramon, 1659 ft, Mar 2017, *Hutton 464A* (CAS); along West Fork Sycamore Canyon near trail from Lower Rock City, MDSP, 1969 ft, Dec 2000, *Norris 100537, 100554* (UC); along Three Springs Trail immediately SW of Rhyne Mine in MDSP, 1558 ft, Feb 2001, *Norris 100824* (UC).

Pohlia wahlenbergii (F.Weber & D.Mohr) A.L.Andrews (Mielichhoferiaceae)

Uncommon. On shaded rock and soil, near spring or streamlet.

Off of trail to Mt. Olympia, northern flank of North Peak, [MDSP], 2035 ft, Feb 2004, *Shevock 24610* (CAS); along Green Ranch Rd where seasonal streamlet crosses, MDSP, 5.6 mi NE of Danville, 2634 ft, Apr 2016, *Hutton 360B* (CAS), *loc. cit.*, same date, *Tan 2016 s.n.* (UC); *loc. cit.*, Jan 2020, *Hutton 613, 614A, 620B* (CAS).

Polytrichum juniperinum Hedw. (Polytrichaceae)

Common. On soil, in partially shaded woodland.

Along upper reaches of Mitchell Canyon Rd, below junction with Deer Flat Rd and Meridian Ridge Rd, MDSP, 3.6 mi S of Clayton, 2002 ft, Aug 2015, *Hutton 205* (CAS); Pine Canyon along road below Castle Rocks (Sunset Trail) at Castle Rocks [Regional] Recreation Area, 480 ft, Feb 2001, *Shevock 20360* (CAS); in Lime Ridge County Reserve near NW corner of MDSP, 984 ft, Apr 2001, *Norris 101338* (UC); along Trail Through Time, Rock City, MDSP, 4.3 mi NE of Danville, 1418 ft, Jun 2016, *Hutton 388* (CAS); along West Fork Sycamore Canyon near trail from Lower Rock City, MDSP, 1968 ft, Dec 2000, *Norris 100506* (CAS, UC).

Polytrichum piliferum Hedw. (Polytrichaceae)

Rare. Intermittent stream bed, mixed woodland.

Rock City [MDSP], Nov 2014, *Tan 2014-306* (UC).

Pseudobraunia californica (Lesq.) Broth. (Hedwigia-ceae)

Abundant. On exposed rock and soil, in chaparral and riparian woodland.
Mary Bowerman Trail [MDSP, summit area], 3695 ft, Jan 2015, *Hutton 67* (CAS); on Eagle Peak Trail at junction with Meridian Ridge Rd, Murchio Gap, MDSP, 3.2 mi S of Clayton, 2330 ft, Mar 2016, *Hutton 335B* (CAS); along trail situated between Mt. Diablo Mine and Perkins Canyon, MDSP, 4.1 mi SE of Clayton, 1352 ft, Apr 2016, *Hutton 344D* (CAS); Rock City, MDSP, Feb 2004, *Game 04/004A* (UC); Donner Canyon, [MDSP], Mar 2015, *Ludwig 31* (CAS).

Pseudocrossidium obtusulum (Lindb.) H.A.Crum & L.E.Anderson (Pottiaceae)
Common. On soil, in mixed riparian woodland.
Along Ray Morgan Rd, off Curry Canyon Rd, near Lewis Spring, on private property adjacent to MDSP, 7.3 mi ENE of Danville, 972 ft, Jan 2017, *Hutton 437B* (CAS); adjacent to Mitchell Canyon trailhead parking area, MDSP, 1.4 mi S of Clayton, 597 ft, Jan 2017, *Hutton 420B* (CAS); along Green Ranch Rd where seasonal streamlet crosses trail, MDSP, 5.6 mi NE of Danville, 2634 ft, Apr 2016, *Hutton 360A* (CAS); along Cardinet Oaks Rd at crossing of Donner Creek, Donner Canyon, MDSP, 2.8 mi SE of Clayton, 1046 ft, Mar 2015, *Hutton 114A* (CAS); in Lime Ridge County Reserve near NW corner of MDSP, 984 ft, Apr 2001, *Norris 101324* (UC).

Ptychomitrium gardneri Lesq. (Ptychomitriaceae)
Rare. On top of large boulders.
Along creek bed at bottom of Mitchell Canyon, Mt. Diablo, Oct 1950, *Koch 3300* (CAS).

Ptychostomum creberrimum (Taylor) J.R.Spence & H.P.Ramsay (Bryaceae)
Common. On soil, soil over rock, or bark in mixed oak woodland.
Along North Peak Trail, near Devil's Pulpit, MDSP, 4.4 mi SE of Clayton, 3309 ft, Apr 2017, *Hutton 516A* (CAS); along Ray Morgan Rd, off Curry Canyon Rd, near Lewis Spring, on private property adjacent to MDSP, 7.3 mi NE of Danville, 972 ft, Jan 2017, *Hutton 437A* (CAS); along West Fork Sycamore Canyon near trail from Lower Rock City, MDSP, 1970 ft, Dec 2000 *Norris 109507* (UC); Mary Bowerman Trail, Summit, [MDSP] Jan 2015, *Tan 2015-102* (UC); along White Canyon at Red Rd near end of Mitchell Canyon Rd in MDSP, 820 ft, Dec 2000, *Norris 100611* (UC).

Ptychostomum pseudotriquetrum (Hedw.) J.R.Spence & H.P.Ramsay ex Holyoak & N.Pedersen (Bryaceae)
Uncommon. On exposed calcareous rock in chaparral or wet rock in woodland.
Donner Canyon, off of Falls Trail above waterfall area, [MDSP], 1800 ft, Jan 2001, *Shevock 20339* (CAS); Donner Canyon, along Falls Trail above junction with Middle Trail [MDSP], 1500ft, Jan 2001, *Shevock 20322* (UC); upper part of Falls Trail,

Donner Canyon, MDSP, 1530 ft, Apr. 2021, *Game 21/002* (UC).
Pulviger a lyellii (Hook. & Taylor) Plášek, Sawicki & Ochyra (Orthotrichaceae)
Orthotrichum lyellii Hook. & Taylor *p.p.*
Abundant. On tree bark and sometimes rock, in mixed oak woodland.
At end of China Wall Rd, at China Wall rock outcrop, MDSP, 2.6 mi NE of Alamo, 946 ft, Aug 2016, *Hutton 412D* (CAS); along Red Rd off Mitchell Canyon Rd, Mitchell Canyon, MDSP, 2 mi SW of Clayton, 811 ft, Jan 2017, *Hutton 428B* (CAS); along Green Ranch Rd, MDSP, 5.6 mi NE of Danville, 2850 ft, Apr 2016, *Hutton 359B* (CAS); Bald Ridge Trail, top of pass, [MDSP], 2674 ft, Apr 2017, *Ludwig 215* (CAS); at Prospectors Gap, MDSP, May 2015, *Hutton 145B* (CAS).
Pulviger a papillosa (Hampe) F.Lara, Draper & Garilleti (Orthotrichaceae)
Orthotrichum lyellii Hook. & Taylor *p.p.*
Common. On tree bark in mixed oak woodland.
Along North Gate Rd at Blue Oak Picnic Area, 2625 ft, Jan 2004, *Shevock 24511A* (CAS); Rocky Point along Devil's Elbow section of the North Peak Trail below Devil's Pulpit, [MDSP], 3399 ft, Jan 2004, *Shevock 24546* (CAS); at end of China Wall Rd, at China Wall rock outcrop, MDSP, 2.6 mi NE of Alamo, 946 ft, Aug 2016, *Hutton 412A* (CAS); on branches of *Quercus chrysolepis*, N slope of Mt. Diablo, at Juniper, 6 mi NE Danville, 2800 ft, June 1962, *Hermann 17370* (UC); along Green Ranch Rd, MDSP, 2835 ft, Jan 2020 *Hutton 628C* (CAS).
Rosulabryum canariense (Brid.) Ochyra (Bryaceae)
Common. On soil in shaded mixed woodland.
Juniper Campground, Deer Flat Rd, [MDSP], Jan 2015, *Tan 2015-103* (UC); Perkins Canyon, [MDSP], Apr 2016, *Tan s.n.* (UC); along Back Creek Trail, approx. 1.7 air mi NNW of Mt. Diablo, MDSP, Feb 2006, *Lenz 2831* (UC); NE corner of John Ginocchio's property on the E side of North Gate Rd, [1.82 mi SE of the North Gate Rd entrance to MDSP], 1231 ft, Apr 2018, *Ludwig 604* (CAS); Mitchell Canyon, [MDSP], Feb. 2015, *Tan 2015-107* (UC).
Rosulabryum capillare (Hedw.) J.R.Spence (Bryaceae)
Abundant. On soil in mixed woodland.
Along Mary Bowerman Trail, at summit of Mt. Diablo, MDSP, 4.4 mi SE of Clayton, 3727 ft, Feb 2017, *Hutton 450* (CAS); at Morgan Sulfur Spring, on side trail off Clark Canyon Trail, off Curry Canyon Rd, on private property surrounded by MDSP, 8.3 mi NE of San Ramon, 1252 ft, Jan 2017, *Hutton 429A* (CAS); along Green Ranch Rd, MDSP, 5.6 mi NE of Danville, 2849 ft, Apr 2016, *Hutton 358B* (CAS); along Donner Canyon Rd, Donner Canyon, MDSP, 1.9 mi SE of Clayton, 636 ft, Mar 2015, *Hutton 105E.3* (CAS); along Burma Rd to Long Ridge, MDSP, 4.2 mi NE of Danville, 1469 ft, Oct 2015, *Hutton 257* (CAS).

Rosulabryum flaccidum (Brid.) J.R.Spence (Bryaceae)
Rare. On rock in mixed oak woodland.

Along trail to Mt. Olympia, northern flank of North Peak, [MDSP], 2200 ft, Feb 2004, *Shevock 24597* (CAS).

Rosulabryum gemmascens (Kindb.) J.R.Spence (Bryaceae)

Common. On exposed rock and partially shaded soils, in mixed oak woodland.

Along North Peak Rd to North Peak close to Prospector's Gap, MDSP, 3.9 mi SE of Clayton, 3067 ft, May 2015, *Hutton 157* (CAS); Rock City Region, Blackhawk Fire Rd near junction with Devil's Slide Trail, [MDSP], 1500 ft, Jan 2004, *Shevock 24538* (CAS); along North Gate Rd at Blue Oak Picnic Area, MDSP, 2625 ft, Jan 2004, *Shevock 24513* (CAS); volcanic dome, Perkins Canyon, MDSP, Aug 2015, *Tan s.n.* (UC); along Knobcone Point Rd to Balancing Rock, MDSP, 5.8 mi NE of San Ramon, 1693 ft, Aug 2016 *Hutton 400* (CAS).

Rosulabryum torquescens (Bruch & Schimp.) J.R.Spence (Bryaceae)

Rare. On rock in mixed oak woodland.

Along trail to Mt. Olympia, northern flank of North Peak, [MDSP], 1245 ft, Feb 2004, *Shevock 24573* (CAS).

Schistidium squarrosus T.T.McIntosh, H.H.Blom, D.R.Toren & Shevock (Grimmiaceae)

Uncommon. On exposed rock, frequently in intermittent streams.

At summit ridge of Mt. Olympia, northern flank of North Peak, MDSP, 2871 ft, Feb 2004, *Shevock 24602* (CAS); Devil's Elbow section of the North Peak Trail below Devil's Pulpit, North Peak Trail, [MDSP], 3389 ft, Jan 2004, *Shevock 24543* (CAS).

Scleropodium californicum (Lesq.) Kindb. (Brachytheciaceae)

Uncommon. On shaded soil in mixed woodland.

Mitchell Canyon, [MDSP], Feb 2015, *Tan 2015-159* (UC); along Stage Rd in Pine Canyon near junction with Buckeye Ravine Trail, Diablo Foothills Regional Park, 3.1 mi NE of Alamo, 426 ft, Jul 2014, *Hutton 6* (CAS); along North Gate Rd at crossing of Little Pine Creek, [MDSP], 925 ft, Jan 2004, *Shevock 24515* (CAS).

Scleropodium cespitans (Müll.Hal.) L.F.Koch (Brachytheciaceae)

Abundant. On shaded soil and rock, in oak savannah woodland.

Along Green Ranch Rd where seasonal streamlet crosses, MDSP, 5.6 mi NE of Danville, 2634 ft, Apr 2016, *Hutton 361D* (CAS); along Burma Rd to Long Ridge, MDSP, 4.6 mi NE of Danville, 1454 ft, Oct 2015, *Hutton 263A* (CAS); Bald Ridge Trail, [MDSP], 3111 ft, Apr 2017, *Ludwig 231* (CAS); along creek, Mitchell Canyon on Mt. Diablo [MDSP], Oct 1950, *Koch 3304* (CAS); alongside

Back Creek Trail, Back Canyon, MDSP, 2.4 mi S of Clayton, 929 ft, Mar 2016, *Hutton 327B*, (CAS).

Scleropodium julaceum E.Lawton (Brachytheciaceae)
Common. On soil, rock and occasionally tree bark, in shaded mixed oak/pine woodland.

Along Castle Rock Rd at border between Diablo Foothills Regional Park and MDSP, 574 ft, Feb 2001, *Norris 100805* (UC); S of Briones-Mount Diablo Trail at China Wall, MDSP, 984 ft, Apr 2001, *Norris 101424* (UC); along Three Springs Trail immediately SW of Rhyne Mine in MDSP, 1558 ft, Feb 2001, *Norris 100845* (UC); along White Canyon at Red Rd near end of Mitchell Canyon Rd in MDSP, S of Clayton, 820 ft, Dec 2000, *Norris 100595* (UC); along cattle road, NE corner of private property on the E side of North Gate Rd, 1.92 mi SE of North Gate Rd entrance to MDSP, 1207 ft, *Ludwig 611* (CAS).

Scleropodium obtusifolium (Mitt.) Kindb. (Brachytheciaceae)

Common. On rock and soil over rock, in mixed woodland.

Rock City, Feb 2004, *Game 04/001* (UC); Adjacent to the Fire Rd on North Peak Trail [MDSP], Feb 2015, *Ludwig s.n.* (CAS); Mt. Diablo, Apr 1923, *Eastwood 137* (CAS); Mitchell's Canyon, Mt. Diablo, Feb 1896, *Howe s.n.* (UC); Rock City region, Sycamore Fire Rd above junction with Trail Through Time [MDSP], 1100 ft, Jan 2004, *Shevock 24530* (CAS).

Scleropodium occidentale B.E.Carter (Brachytheciaceae)

Common. On soil in shaded mixed woodland.

Along Stage Rd in Pine Canyon near junction with Buckeye Ravine Trail, Diablo Foothills Regional Park, 3.1 mi NE of Alamo, 420 ft, Jul 2014, *Hutton 11* (CAS); along trail to Mt. Olympia, northern flank of North Peak, [MDSP], 1549 ft, Feb 2004, *Shevock 24580* (CAS); adjacent to fire road, North Peak Trail, [MDSP], 3070 ft, Feb 2015, *Ludwig 23* (CAS); Rock City region along Trail Through Time near junction with Devil's Slide Trail [MDSP], 1200 ft, Jan 2004 *Shevock 24519* (CAS); at streamlet crossing S of Mt. Diablo Mine and N of Perkins Canyon, MDSP, 794 ft, Apr 2016, *Hutton 346C* (CAS).

Scleropodium touretii (Brid.) L.F.Koch (Brachytheciaceae)

Common. On soil in shaded mixed woodland.

Donner Canyon, [MDSP], Mar 2015, *Tan 2015-164* (UC); On Curry Canyon Rd between junctions with Knobcone Pt Rd and Frog Pond Rd, MDSP, 4.4 mi NE of Danville, 1757 ft, Jun 2015, *Hutton 174A* (CAS); on N-facing slopes of Pine Ridge above Pine Pond in MDSP, 623 ft, Feb 2001, *Norris 100742* (UC); Mitchell's Canyon, Mount Diablo [MDSP], Feb 1896, *Howe s.n.* (Duke; NY); NE corner of John Ginochio's property on the E side of North Gate Rd [1.92 mi SE of North Gate Rd entrance to MDSP], 1214 ft, Apr 2018, *Ludwig 606* (CAS).

Syntrichia laevipila Brid. (Pottiaceae)

Common. On bark of trees, mixed oak woodland. Long Ridge above North Gate Rd, [MDSP], 980 ft, Jan 2004, *Shevock, Thayer & Bartosh 24499* (CAS); along West Fork Sycamore Canyon near trail from Lower Rock City, MDSP, 1969 ft, Dec 2000, *Norris 100522* (UC); in Lime Ridge County Reserve near NW corner of MDSP, 984 ft, Apr 2001, *Norris 101335, 101358* (UC); along trail to Rock Ridge from Juniper Campground, MDSP, March 2001, *Norris 101090* (UC).

Syntrichia latifolia (Bruch ex Hartm.) Huebener (Pottiaceae)

Common. On tree bark and rock, in mixed oak woodland.

Along Frog Pond Rd at Mountain Spring Creek crossing, MDSP, 6.6 mi NE of San Ramon, 1552 ft, Jun 2015, *Hutton 168C.3* (CAS); adjacent to Mitchell Canyon trailhead lower parking lot, MDSP, 1.4 mi S of Clayton, 596 ft, Jan 2017, *Hutton 421A* (CAS); along Curry Canyon Rd between junctions with Knobcone Pt Rd and Frog Pond Rd, MDSP, 4.4 mi NE of Danville, 1703 ft, Jun 2015, *Hutton 160* (CAS); along Finley Rd where creek joins it, on private property adjacent to Morgan Territory Regional Preserve, 5 mi NE of San Ramon, 950 ft, Feb 2017, *Hutton 458* (CAS); Green Ranch Rd, [MDSP], Apr 2016, *Tan s.n.* (UC).

Syntrichia montana Nees (Pottiaceae)

Common. On rock and soil and occasionally on tree bark, in mixed oak woodlands.

Donner Canyon, [MDSP], Mar 2015, *Tan 2015-166* (UC); Dan Cook Canyon, [MDSP], Oct 2015, *Tan s.n.* (UC); along trail to Mt. Olympia, northern flank of North Peak, [MDSP], 1950 ft, Feb 2004, *Shevock 24594* (CAS); on N-facing slopes of Pine Ridge above Pine Pond in MDSP, 623 ft, Feb 2001, *Norris 100752* (UC); Mary Bowerman Trail, Summit, [MDSP], Jan 2015, *Tan 2015-167* (UC).

Syntrichia papillosa (Wilson) Jur. (Pottiaceae)

Rare. On *Quercus agrifolia* trunk.

Arroyo Del Cerro [John Ginochio's property, SE of North Gate Rd entrance to MDSP], 1231 ft, Apr 2018, *Ludwig 618* (CAS).

Syntrichia papillosissima (Copp.) Loeske (Pottiaceae)

Uncommon. On dry soil and rock, among scrubby chaparral.

Between North and South Peaks in Mt. Diablo State Park, 3000 ft, Jan 2015, *Caswell-Levy s.n.* (UC); along North Peak Rd, close to Prospectors Gap, 2998 ft, May 2015, *Hutton 158* (CAS).

Syntrichia princeps (DeNot.) Mitt. (Pottiaceae)

Abundant. On soil, rocks, and tree trunks, in grasslands and open woodlands.

Mitchell Canyon, Mt. Diablo [MDSP], Feb 1896, *Howe s.n.* (UC); along Green Ranch Rd, MDSP, 5.4 mi NE of Danville, 2853 ft, Apr 2016, *Hutton 353* (CAS); at edge of parking lot at Rock City, MDSP, 4

mi NE of Danville, 1607 ft, Dec 2014, *Hutton 52* (CAS); along Mary Bowerman Trail, at summit of Mt. Diablo, 50 yds from trailhead on S flank of mountain, MDSP, 3700 ft, Jan 2015, *Hutton 60* (CAS); in Lime Ridge County Reserve near NW corner of MDSP, 984 ft, Apr 2001, *Norris 101356* (UC).

Syntrichia ruralis (Hedw.) F.Weber & D.Mohr (Pottiaceae)

Abundant. On shaded soil and rocks in mixed woodlands.

Along North Peak Rd to North Peak close to Prospector's Gap, MDSP, 3.9 mi SE of Clayton, 3067 ft, May 2015, *Hutton 289B* (CAS); adjacent to trail along Burma Rd to Long Ridge, MDSP, 4.6 mi NE of Danville, 1490 ft, Oct 2015, *Hutton 260B* (CAS); along West Fork Sycamore Canyon near trail from Lower Rock City, MDSP, 1969 ft, Dec 2000, *Norris 100536* (UC); along Donner Canyon Rd, Donner Canyon, MDSP, 1.5 mi SE of Clayton, 555 ft, Mar 2015, *Hutton 102A* (CAS); below Observation Deck at Mount Diablo summit, MDSP, 4.4 mi SE of Clayton, 3796 ft, Jul 2015, *Hutton 196* (CAS).

Syntrichia Brid., sp.: (Pottiaceae)

Rare. On moist diffusely lit face of vertical sandstone outcrop in *Quercus agrifolia* forest.

Along Castle Rock Rd at border between Diablo Foothills Regional Park and MDSP, 574 ft, Feb 2001, *Norris 100802* (UC).

This specimen has been identified by B. Mishler as a currently undescribed species of *Syntrichia* that is known elsewhere from California and is similar to *S. princeps*. It will soon be described by Brinda, Lazo and Mishler (B. Mishler, University of California, Berkeley, personal communication).

Timmiella anomala (Bruch & Schimp.) Limpr. (Pottiaceae)

Abundant. On shaded soil, trail banks, in mixed oak woodlands.

Along Donner Canyon Rd, Donner Canyon, MDSP, 2.4 mi SE of Clayton, 858 ft, Mar 2015, *Hutton 109* (CAS); along Knobcone Point Rd to Balancing Rock, between junctions with Curry Canyon Rd and Black Hawk Ridge Rd, MDSP, 4.7 mi NE of Danville, 1619 ft, Aug 2016, *Hutton 401* (CAS); along trail to Mt. Olympia, northern flank of North Peak, [MDSP], 1800 ft, Feb 2004, *Shevock 24585* (CAS); along Three Springs Trail immediately SW of Rhyne Mine, 1558 ft, Feb 2001, *Norris 100850* (UC); in lime Ridge County Reserve near NW corner of MDSP, 984 ft, Apr 2001, *Norris 101352* (UC).

Timmiella crassinervis (Hampe) L.F.Koch (Pottiaceae)

Abundant. On soil and soil over rock, in shaded woodlands.

Mary Bowerman Trail, Summit, [MDSP], Mar 2015, *Tan 2015-175* (UC); on bank at right of deserted cabin on Sulfur Spring Trail at sulfur spring and junction with spur trail, Morgan Territory Regional

Preserve, 8 mi NE of San Ramon, 1013 ft, Feb 2017, *Hutton 455B* (CAS); adjacent to trail in fireburn area, along trail situated between Mt. Diablo Mine and Perkins Canyon, MDSP, 4.3 mi SE of Clayton, 1269 ft, Apr 2016, *Hutton 342C* (CAS); Pine Canyon along trail to Castle Rocks [CRRRA], 650 ft, Feb 2001, *Shevock 20345* (CAS); at edge of trail along Frog Pond Rd at Mountain Spring Creek crossing, MDSP, 6.6 mi NE of San Ramon, 1750 ft, Feb 2017, *Hutton 452A* (CAS).

Tortula acaulon (With.) R.H.Zander (Pottiaceae)
Common. On soil, edges of trails, and sparse meadowlands.

Near junction of North Peak Trail and North Peak Rd just east of Prospector's Gap, [MDSP], 3014 ft, May 2015, *Ludwig 63* (CAS); on trail bank along White Canyon at Red Rd near end of Mitchell Canyon Rd in MDSP, S of Clayton, [MDSP], 820 ft, Dec 2000, *Norris 100578* (UC); on earthen dam of Pine Pond, along Stage Rd in MDSP, E of Diablo Foothills Regional Park, 623 ft, Feb 2001, *Norris 100736* (UC); along trail in Lime Ridge County Reserve near NW corner of MDSP, 984 ft, Apr 2001, *Norris 101351* (UC); lower Curry Canyon on private land, Apr 2017, *Game 17/003* (UC).

Tortula atrovirens (Sm.) Lindb. (Pottiaceae)
Common. On exposed soil and boulders, often calcareous.

Pine Canyon along trail to Castle Rocks [CRRRA], 650 ft, Feb 2001, *Shevock 20348* (CAS); Rock City Region, Blackhawk Fire Rd above junction with Trail Through Time and forks of Sycamore Creek, [MDSP], 1300 ft, Jan 2004, *Shevock 24536* (CAS); Donner Canyon, trail to the waterfalls below Mount Diablo Peak, [MDSP], 1500 ft, Feb 2004, *Shevock 24619* (CAS); Prospector's Gap, [MDSP], *Shevock 24565* (CAS); at top of Pine Ridge above Pine Pond in MDSP, 984 ft, Feb 2001, *Norris 100755* (UC).

Tortula bolanderi (Lesq. & James) M.Howe (Pottiaceae)

Common. On soil in mixed woodland
Along trail to Rock Ridge from Juniper Campground, MDSP, 3445 ft, Mar 2001, *Norris 101079* (UC); along Castle Rock Rd at border between Diablo Foothills Regional Park and MDSP, 574 ft, Feb 2001, *Norris 100734* (UC); Arroyo Del Cerro [John Ginochio's property, SE of North Gate Rd entrance to MDSP], 1242 ft, Apr 2018, *Ludwig 619* (CAS); along West Fork Sycamore Canyon near trail from Lower Rock City [MDSP], 1969 ft, Dec 2000, *Norris 100551* (UC); on South Peak [MDSP], 3700 ft, Mar 1955, *Howell H.152* (CAS) [previously identified as *Tortula inermis* (Brid.) Mont. by Fay MacFadden].

Tortula brevipes (Lesq.) Broth. (Pottiaceae)
Rare. On calcareous soil and rocks, among mixed shrubs.

Pine Canyon along trail below Castle Rocks to road (Sunset Trail) [CRRRA], 700 ft, Feb 2001, *Shevock 20358* (CAS).

Tortula guepinii (Bruch & Schimp.) Broth. (Pottiaceae)

Uncommon. On trailside bank on grassy slope and calcareous boulder.

Donner Canyon, trail to the waterfalls below Mount Diablo Peak, [MDSP], 1500 ft, Feb 2004, *Shevock 24619A* (CAS); along Ohlone Trail, Lime Ridge Open Space, 5.08 mi NE of Walnut Creek, 464 ft, Feb 2202 *Hutton 638B* (CAS).

Tortula inermis (Brid.) Mont. (Pottiaceae)

Rare. On exposed soil and rock.

Mary Bowerman Trail, Summit, [MDSP], Jan 2015, *Tan 2015-176* (UC).

Tortula leucostoma (R.Br.) Hook. & Grev. (Pottiaceae)

Rare. On shaded soil at trail edge in open mixed woodland.

Along Eagle Peak trail near Mitchell Rock, MDSP, 1476 ft, Mar 2006, *Norris 108815* (UC).

Tortula muralis Hedw. (Pottiaceae)

Common. On exposed, calcareous rocky trailside banks, open country or oak woodland.

On road to access trail to Mount Olympia, northern base of North Peak, [MDSP], 900 ft, Feb 2004, *Shevock 24616* (CAS); S side of Mt. Diablo, [MDSP], 1000 ft, May 1955, *Howell s.n.* (CAS); Mt. Diablo, Jun 1955, *Howell s.n.* (UC); near start of Ohlone Trail, Lime Ridge Open Space, 463 ft, Feb 2020, *Game 20/072* (UC).

Tortula subulata Hedw. (Pottiaceae)

Common. On exposed soil and rocks, at trail edges.
Along trail situated between Mount Diablo Mine and Perkins Canyon, MDSP, 4.4 mi SE of Clayton, 1116 ft, Apr 2016, *Hutton 341* (CAS); Donner Canyon, off Falls Trail above junction with Middle Trail, [MDSP], 1500 ft, Jan 2001, *Shevock 20335* (CAS); along Mary Bowerman Trail, at summit of Mount Diablo, MDSP, 4.2 mi SE of Clayton, 3685 ft, Feb 2016, *Hutton 290A* (CAS); *loc. cit.*, 3800 ft, same date, *Tan 2016 s.n.* (UC)

Weissia controversa Hedw. (Pottiaceae)

Abundant. On soil or rock close to water.

Along Mary Bowerman Trail, at summit of Mount Diablo, MDSP, 4.2 mi SE of Clayton, 3674 ft, Feb 2016, *Hutton 291C* (CAS); Back Canyon, upper third or quarter, [MDSP], Apr 2016, *Game 16/039* (UC); along Frog Pond Rd at Mountain Spring Creek crossing, MDSP, 6.6 mi NE of San Ramon, 1552 ft, Jun 2015, *Hutton 168C.2* (CAS); Rock City region, along Trail Through Time near junction with Devil's Slide Trail, west fork of Sycamore Creek, [MDSP], 1200 ft, Jan 2004, *Shevock 24518* (CAS); along Three Springs Trail immediately southwest of Rhyne Mine, [MDSP], 1558 ft, Feb 2001, *Norris 100820* (UC).



FIG. 3. Benito Tan near Prospectors Gap, Mount Diablo, Feb. 26th 2015. Photo by Susan Fawcett.

IN MEMORIAM

During the course of this project Benito Tan (Fig. 3) passed away after an unexpected illness. His untimely death was felt by all who were involved with the project. It was through his urging that the survey was initiated in the first place. He enjoyed a worldwide reputation as an expert bryologist, and was one of the world’s leading experts in tropical bryophytes, with an outstanding publication record. His obituary has been published by Ho and Shevock (2018). Following a career in the Department of Biological Sciences, National University of Singapore, he came to California and became associated with the University of California Herbarium at Berkeley in 2013. We were most fortunate to have been associated with him. He is greatly missed.

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APPENDIX 1

DOUBTFUL OR UNCONFIRMED TAXA EXCLUDED FROM THE MAIN LIST

LIVERWORTS

Cephaloziella howei R.M.Schust. (Cephaloziellaceae)
This name has been applied to a collection from Mt. Diablo (Feb 1896, *M.A. Howe 1153*, type, (NY)). However, the name has never been published and David Wagner, who has examined this specimen, considers it to be *C. divaricata* (D. Wagner, Northwest Botanical Institute, personal communication 2020).

Cephaloziella stellulifera (Taylor ex Carrington & Pearson) Croz. (Cephaloziellaceae)
On moist, diffusely lit soil of steep bank of rivulet in forest.

Along White Canyon at Red Rd near end of Mitchell Canyon Rd in MDSP, S of Clayton, 820 ft, Dec 2000, *Norris 100610* (UC). David Wagner annotated this specimen in 2017 as follows: “(?Possible) only fragments of sterile shoots”. Given the uncertainty, we are including it in the unconfirmed list.

***Riccia glauca* L. (Ricciaceae)**

Three specimens from Mt. Diablo at UC, *Norris 100587*, *Norris 100623* and *Norris 100857*, are listed as *Riccia glauca* in the Consortium of North American Bryophyte Herbaria database, but we have re-identified these as *R. sorocarpa* Bisch.

MOSSES

***Conardia compacta* (Müll.Hal.) H.Rob. (Amblystegiaceae)**

A Mount Diablo specimen from Mitchell Canyon, Oct 1950, *Koch 3302* (ILL, NY) has been identified at NY as *Conardia compacta* or its synonym *Amblystegium compactum* (Müll.Hal.) Aust., at ILL. We have not seen the specimen, but images were kindly provided to us from NY by Laura Briscoe. Based on the images, we are doubtful of the *Conardia* identification. The plant may be *Hygroamblystegium varium* (Hedw.) Mönk., and we provisionally exclude *Conardia compacta* from the Diablo list.

***Didymodon occidentalis* R.H.Zander (Pottiaceae)**

The following specimen was identified by D.H. Norris as *Didymodon occidentalis* from Mount Diablo: along White Canyon at Red Rd near end of Mitchell Canyon Rd, [MDSP], 820 ft, Dec 2000, *Norris 100606* (UC). The specimen is missing, so we have not been able to confirm the identification. *Norris 100485* from Sycamore Canyon was originally identified as *D. occidentalis*, but has been re-determined by D. Toren as *D. nicholsonii*, and is listed above under that species. It is possible that *Norris 100606*, if found, will be re-identified as *D. nicholsonii*.

***Didymodon trifarius* (Hedw.) Röhl (Pottiaceae)**

Two specimens from North Rd, Mt. Diablo, Jan 1954, *P. Raven R-24* (PH) and *P. Raven & F.A. MacFadden 21834* (TENN), are listed in the Consortium of North American Bryophyte Herbaria database as *Didymodon trifarius*. They may represent a single collection. *D. trifarius* is a synonym of *Saelania glaucescens* (Hedw.) Broth., a moss not known elsewhere from California. Zander (2007) reported that *D. trifarius* is a name frequently misapplied to other *Didymodon* Hedw., species, and we consider these specimens to be probably misidentified.

***Encalypta rhaptocarpa* Schwägr. (Encalyptaceae)**

A specimen, *Howe 146* (UBC), is listed as *Encalypta rhaptocarpa* from “Mitchell’s Canyon, Mt. Diablo”, Feb 1896. A duplicate packet at NY is determined as *E. vulgaris*. We have not seen the specimen, but we construe other Mt. Diablo *Encalypta* Hedw., collections as *E. vulgaris*. Magill (2007) wrote that *E. vulgaris* has at times been combined with *E. rhaptocarpa*, that some specimens are difficult to place, and that *E. vulgaris* is most frequently found in the western United States, whereas *E. rhaptocarpa* is more common throughout the north. We consider it likely that this specimen is *E. vulgaris* and we provisionally exclude *E. rhaptocarpa* from Mt. Diablo.

***Gemmabryum violaceum* (Crundw. & Nyholm) J.R.Spence (Bryaceae)**

The Consortium of North American Bryophyte Herbaria database lists *Norris 100525* (UC) as this species, from moist, diffusely lit thin soil over sandstone in patch of

chaparral in forest, along West Fork Sycamore Canyon near trail from Lower Rock City, 1969 ft. We have been unable to find this specimen and thus cannot confirm the identification. A duplicate packet with this number was found at CAS, but contained no Bryaceae species.

***Grimmia donniana* Sm. (Bryaceae)**

Three specimens are listed from Mount Diablo as this taxon in the Consortium of North American Bryophyte Herbaria database. They are *Bolander 283* (NY), *Koch 1607b* (NY) and *M. M. Reid CA0012* (FH). We have not seen these specimens, but since *G. donniana* is not known elsewhere in California and is a species of higher elevations or more northern locations we are doubtful of the identifications.

***Grimmia incurva* Schwägr. (Grimmiaceae)**

Norris 100795 (UC), along Castle Rock Rd at border between Diablo Foothills Regional Park and MDSP, 574 ft, Feb 2001, is listed as *G. incurva* in the Consortium of North American Bryophyte Herbaria database. We are currently unable to locate this specimen and the elevation given is lower than is usual for this taxon, hence we are doubtful of the identification.

***Grimmia longirostris* Hook. (Grimmiaceae)**

The Consortium of North American Bryophyte Herbaria database lists *Norris 101412* (UC) as this species, from moist, diffusely lit sandstone outcrop in grassland and chaparral with *Quercus* spp., south of Briones-Mount Diablo Trail at China Wall [MDSP], 984 ft, Apr 2001. We are unable to locate this specimen and cannot confirm the identification.

***Gymnostomum aeruginosum* Sm. (Pottiaceae)**

Three specimens from Mt. Diablo are listed in the Consortium of North American Bryophyte Herbaria database as *Gymnostomum aeruginosum*. We have re-identified one of them, *Norris 100569* (UC) as *G. viridulum*. We have been unable to find the other two collections (*Norris 100799* (UC) and *Norris 109565* (UC)). *Gymnostomum aeruginosum* is unconfirmed on Mount Diablo.

***Hennediella heimii* (Hedw.) R.H.Zander (Pottiaceae)**

Three specimens, *Norris 100551*, *100734*, and *100781* (all UC) are listed from Mount Diablo as this taxon on the Consortium of North American Bryophyte Herbaria database. These have been annotated by M. J. Cano as *Syntrichia bolanderi* (Lesq.) R.H.Zander, synonymous with *Tortula bolanderi* (Lesq. & James) M.Howe. *Hennediella heimii* is therefore excluded from our current checklist.

***Homalothecium aeneum* (Mitt.) E.Lawton (Brachytheciae)**

Three specimens from Mt. Diablo, *Shevock 20350* (CAS), *Norris 100757* (UC) and *Norris 101086* (UC) identified as *Homalothecium aeneum* by the collectors have been re-identified as *Homalothecium pinnatifidum* by David Toren (California Academy of Sciences, personal communication 2020). We therefore exclude *H. aeneum* from the Mt. Diablo list.

***Leskea* Hedw., sp.**

One specimen, *Norris 100853* (UC), is listed in the Consortium of North American Bryophyte Herbaria database as *Leskea* sp. We have re-identified this as *Ceratodon purpureus* (Hedw.) Brid. and we exclude *Leskea* from the Mt. Diablo list.

***Pleuridium subulatum* (Hedw.) Rabenh. (Ditrichaceae)**

The Consortium of North American Bryophyte Herbaria database lists *Norris 100552* (UC) as this species, from N-facing slopes of Mt. Diablo at Mt. Diablo Fire Interpretive

Trail around summit, 3773 ft, Jan 2007. The specimen is missing and the identification remains unconfirmed.

Ptychostomum lonchocaulon (Müll.Hal.) J.R.Spence

One specimen from Mt. Diablo, *Norris & Hillyard 109824* (CAS) is identified as *Ptychostomum lonchocaulon* on the Consortium of North American Bryophyte Herbaria database. We have re-identified a UC duplicate of this collection as *P. creberrimum*, and thus exclude *P. lonchocaulon*.

Racomitrium heterostichum (Hedw.) Brid. (Grimmiaceae)

Three specimens are listed from Mount Diablo in the Consortium of North American Bryophyte Herbaria database as *Racomitrium heterostichum*. These are *Sanford s.n.*, Sep 1960, (KE), *Koch 1575*, May 1947, (FH; MICH), and *Koch 3341*, Oct 1950, (UC and elsewhere; listed as *Racomitrium ericoides* (Brid.) Brid., at ISC and *Bucklandiella microcarpa* (Hedw.) Bedn.-Ochyra & Ochyra at COLO). We have re-identified *Koch 3341* at UC and from BRY (where it is also numbered *Koch sb-641*) as *Grimmia leibergii* Paris. A duplicate at NY has been also been annotated as *G. leibergii* by H.C.Greven. We identified *Koch 1575* as *Grimmia leibergii* based on images supplied by FH. We consider it likely that *Sanford s.n.*, (KE) is also a *Grimmia* species, but current COVID 19 restrictions prevented us from accessing the specimen.

Schistidium Bruch & Schimp., spp. (Grimmiaceae)

A specimen from Mount Diablo, Jan 1863, *Bolander s.n.* (UC) was originally identified as *Schistidium confertum* (Funck) Bruch & Schimp. It was re-identified as *S. apocarpum* (Hedw.) Bruch & Schimp., by B. Bremer in 1980 and we concur with this opinion. *Schistidium apocarpum* is not otherwise known from western America south of Washington State. A specimen with equivalent information (Mt. Diablo, 1000 ft, undated, *Bolander s.n.*

(MO) is also named as *S. confertum* and may be part of the same collection. We have not seen it. *Schistidium confertum* is known from California, but without more information we consider it plausible that Bolander collected these specimens elsewhere and mistakenly attributed them to Mount Diablo.

Syntrichia norvegica F.Weber (Pottiaceae)

Two specimens from Mt. Diablo, *Norris 100802* (UC) and *Norris 109555* (UC), were identified as this by the collector. *Norris 100802* has been re-identified by B. Mishler as a known, but currently undescribed species of *Syntrichia* (B. Mishler, University of California, Berkeley, personal communication, see *Syntrichia* species, above). We have not been able to locate *Norris 109555*, but we consider an occurrence of *S. norvegica* on Mt. Diablo unlikely.

Triquetrella californica (Lesq.) Grout (Pottiaceae)

The type collection (at MO) of this rare moss (published under the basionym *Anomodon californicus* Lesq., see Lesquereux (1868)) was collected by H.N. Bolander, and the packet states "On Mt. Diablo California, Catalog of Plants of Pacific Coast No. 203". A duplicate packet at NY adds the information "on damp rocks". The date is not given, but was presumably between 1861, when Bolander first came to San Francisco, and 1868, when the species was published. We can find no other records from Mt. Diablo of this moss, and currently known local populations are closer to the coast or in more mesic habitats. Bolander was not noted for precision in recording details of collections, and we consider it plausible that he found the species elsewhere in the region nearer to its current populations and mistakenly attributed it to Mount Diablo.

Weissia ligulifolia (E.B.Bartram) Grout (Pottiaceae)

A specimen from Mitchell Canyon Rd, *Norris 100613* (UC), has been reported as this species. We have re-identified it as *Weissia controversa*.

A PRELIMINARY SPECIMEN-BASED CATALOGUE OF THE MOSS SPECIES FOUND IN NAPA COUNTY, CALIFORNIA

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ABSTRACT

Napa County, in California's North Coast Range, is well known for its plant diversity. However, until now no one has published a listing of bryophytes for Napa County. I present a catalogue of 158 moss species in 77 genera and 31 families collected and confirmed as occurring within Napa County. The catalogue summarizes 1701 collections (1550 by me). Collection dates encompass 1866 through 2018. I examined selected collections at CAS, UC, and other herbaria, and sent many of my collections to specialists for their identification. I did not collect 11 species reported previously by others. Eighty-six species are collected at only one or two locations. The catalogue includes a summary of the distribution of each species in Napa County and a citation of reference collections deposited in herbaria (CAS, ILL, and UC). In addition to the cited collections, I deposited most of my other Napa County materials at CAS and UC. The number of collections of each species, their number of locations where collection occurred, and whether specimens were collected by me or others is presented. A comparison of the increasing numbers of mosses collected in the Napa County over time with that of nearby areas and California is summarized.

Key Words: bryophyte, California flora, moss, Napa County.

Napa County is situated within the North Coast Range of California at the northeastern edge of the San Francisco Bay Region. It is bounded by Sonoma County to the west, Lake County to the north, Yolo and Solano Counties to the east, and Solano County and Richardson Bay of San Francisco Bay to the south (Fig. 1). General geographic boundaries of Napa County include the Knoxville and Livermore Ranch areas to the north, the Western Mountains (also referred to as Mayacamas Mountains) to the west, the Berryessa Area to the east, and the Napa River Marshes to the south. Located within 75 miles are more than 10 colleges and universities with herbaria. However, it is notable that very few mosses have been collected within Napa County prior to this study. Floristic studies in Napa County have focused instead on vascular plants. The only previous report on mosses in Napa County treated the San Francisco Bay Area flora but included few records for Napa County (Whittemore 2009, 2020). The bryophyte collections summarized in this catalogue focus on Napa County and also add to our understanding of the distribution of mosses in California. Documenting the natural distribution of plants is important for understanding their biology as well as for identifying threatened or endangered species and for guiding conservation efforts. An increasing understanding of the bryoflora of California has recently resulted in the inclusion of mosses within the enumeration of rare, threatened and endangered moss species in the *Inventory of Rare and Endangered Plants of California* (California Native Plant Society [CNPS] 2020).

DESCRIPTION OF STUDY AREA

Napa County consists of approximately 2100 km² including the incorporated cities and surface area of Lake Berryessa. Napa County is generally divided into three major watersheds: the Napa River watershed comprises the western half, the Putah Creek watershed to the northeast drains through Lake Berryessa eventually to the Sacramento River, and Gordon and Wooden Valleys drain to the southeast to the Suisun Marsh. The following description of Napa County and its principal physical and biological features are drawn from a summary by Rae (2003), the Baseline Data Report compiled by Jones & Stokes (Napa County 2005) during development of the Napa County General Plan, the Napa Valley Historical Ecology Atlas by Grossinger (2012), and Moores et al. (2020).

The Napa River watershed (about 1103 km²) drains into San Pablo Bay near the city of Vallejo. The drainage network is shaped by a series of northwest, south, and southeast trending mountain ranges and intervening valleys that form three hydrologically discrete watersheds: Napa River, Putah Creek/Lake Berryessa, and Suisun Creek. Water bodies include Lake Berryessa, Lake Hennessey, the Napa River, and associated tributaries to the Napa River (e.g., Conn Creek, Rector Creek, and Milliken Creek). In general, tributaries to major drainages form canyons in their steeper upstream reaches where they flow over the more resistant bedrock of the mountainous areas. Watercourses typically descend from steep headwater reaches onto alluvial fan surfaces, and then on to a valley floor setting. The upper reaches typically have very short, higher gradient channels while the lower reaches

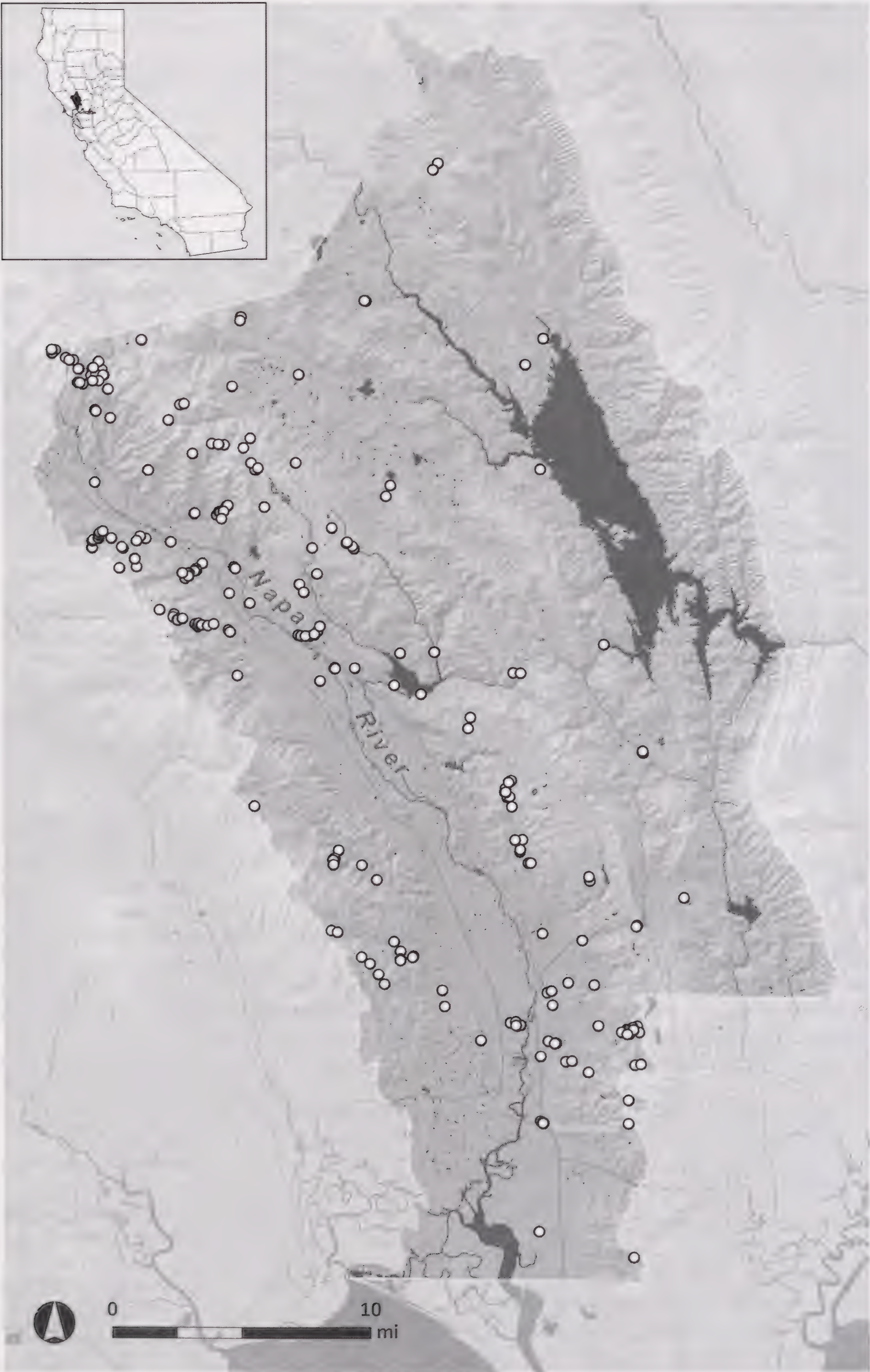


FIG. 1. Locations of collections within Napa County with map of the state of California as inset with Napa County shaded.

(Napa River and Putah Creek) historically exhibited a meandering, low gradient channel (mostly channeled due to gradually more intensive agricultural and urban land use). Most of the upstream reaches of tributaries are seasonal (ephemeral or intermittent), while some are perennial; downstream reaches, especially of the larger streams, are generally perennial. There are varying topographic conditions (Mayacamas Mountains, Blue Ridge, and Vaca Mountains) and a wide variety of vegetation communities. Elevations in Napa County range from approximately sea level subject to tidal action at the south end of the Napa Valley to approximately 1324 m (mean sea level) at Mt. St. Helena. Evergreen and coniferous forest can be found predominantly in the mountains west and east of the northern portion of Napa Valley. Napa County includes 160 km² of State lands and 250 km² of Federal lands. There are approximately 210 km² of active vineyards, with smaller areas of crops and orchards and approximately 220 km² of grazing land. Along ridges from the east side of the Napa Valley to Lake County to the north and Yolo and Solano counties to the east there are many areas of bedrock exposure of volcanics, marine sediments, and ultramafics. Napa County is particularly diverse from the standpoint of plants; an area of overlap for many species distributions occupying unique ecotones at the limit of their ranges. Although Napa County as a whole comprises only 0.5% of California, it contains 1207 native plant taxa, or 32% of the state's native flora (Thorne et al. 2004; Ruygt 2020).

Napa County's Mediterranean climate is composed of distinct, separate seasons (cool wet winters and hot dry summers). Approximately 90% of the precipitation occurs between November and April, and precipitation varies significantly throughout Napa County, both in a north-south direction and with elevation. Additional precipitation in the form of fog enters Napa County from San Francisco Bay to the south, from Sonoma County to the west near Calistoga, and from Solano County to the east from the city of Napa. A maritime influence of cool onshore ocean breezes enters from the south. Although average temperatures may vary from a high of 20°C (69°F) to a low of 6°C (44°F), extremes may extend to a high of 42°C (108°F) and a low of -12°C (10°F) (Napa County 2005).

Napa County is a hotspot of native plant diversity (Stebbins and Major 1965; Thorne et al. 2004; Ruygt 2020), as well as rare plants. Special status vascular plant habitats are found in all areas, although most rare plant occurrences are concentrated in the central and northwestern portions of Napa County (California Native Plant Society 2020). Napa County contains 55 documented occurrences of the 2,089 rare plant species in California that are tracked by the California Natural Diversity Database (California Department of Fish and Wildlife 2020) and California Native Plant Society (2020). This represents 2.5% of the state's tracked rare plant species on

less than 0.5% of the state's area, indicating that the density of rare plant species documented in Napa County is five times the average for California overall. Many of these rare species occur on specific substrates such as alkaline or serpentine soils or are associated with specific assemblages of vascular plants such as oak woodlands or chaparral. Some habitats support a disproportionately large number of special-status plants. For example, the 29 special-status plant species associated with Napa County's serpentine grasslands represent 36% of Napa County's special-status plant species but occur on only 0.4% of Napa County's area. Other communities and habitat features that are especially critical for rare plants include riparian woodland, wetlands, and rock outcrops. Several special status vascular plants are associated with specific habitats that are rare in Napa County. This floristic diversity is a function of Napa County's diverse topographic and geologic landscape, reaching from marshes at sea level to the peak of Mt. St. Helena (1323 m), as well as Napa County's large variations in climate conditions. Napa County has been recognized as a center for endemism and speciation for the California flora. Detailed descriptions of the vegetation and plant communities of Napa County are presented by Thorne et al. (2004) and Ruygt (2020). The vegetation of Napa County contains endemic and widespread species, some of which are limited to Napa County and others whose northern or southern distribution ends at the Napa County line.

The geology of Napa County contributes significantly to its habitat diversity (Stebbins and Major 1965). According to Moores et al. (2020), the California Coast Ranges is one of the most geologically diverse areas of the Pacific Coast. All three rock categories are represented by a spectrum of rock types. Sedimentary rocks include sandstones, shales and cherts. Igneous rocks include basalt, gabbro, peridotite, and rhyolite. And metamorphic rocks include both igneous and sedimentary deposits (greenschist, blueschist, eclogite, and serpentinite). The oceanic crust and mantle meet, resulting in numerous faults and mixture of materials. Volcanic activity has added materials over time. One prominent feature is the Franciscan Formation, a mélange exhibiting diverse materials in varying size deposits in proximity to significantly different materials. The resulting landscape is composed of chemically and physically different parent materials and soils in patches of different sizes. For instance, a mud flow can be found adjacent to serpentinite, but dwarfed by nearby gabbro or basalt deposits. Defined by topographic and microclimatologic variation, potential moss habitats are numerous and of varying sizes.

There has been very little urbanization or urban development in the unincorporated areas of Napa County over the past fifteen years, while at the same time considerable growth has occurred in the wine industry, and its related support activities. Fire is a recurring factor affecting the development and

distribution of plant communities. About 4 million acres has burned throughout California within the past three years (CalFire Public Information Office, personal communication). Within the past ten years approximately 45% of the undeveloped lands in Napa County have been burned by wildfires.

HISTORY OF MOSS COLLECTION IN NAPA COUNTY

Other notable regional bryophyte surveys in California include those of Santa Cruz County (Kellman 2003), Plumas National Forest (Dillingham 2015), Lake County (Toren 2015), Mt. Diablo, Contra Costa County (Hutton et al. 2021), and an unpublished checklist for ten counties adjoining or close to San Francisco Bay by Whittemore (2009). Reflecting the increased interest in the mosses of the Bay Area, this work was revised and published (Whittemore 2020).

Thiers and Emory (1992) provide a thorough overview of the history of bryological research in California. Their review shows that mosses were reported in California starting in 1856. Collections reported from Napa County began by 1868 (Lesquereux 1868) and 1886 (Howe 1896). Other early collections are documented with herbarium packets (Consortium of North American Bryophyte Herbaria [CNABH] 2020). Marilyn Mann made early collections in Napa County of what was to become decades later *Schistidium splendens* T.T.McIntosh, H.H.Blom, D.R.Toren & Shevock and *Grimmia torenii* Hastings (at NY) from the Napa Soda Springs Resort area. Despite collecting several vascular plants on Mt. St. Helena during three visits (4 May 1893, 23 September 1893, and 19 July 1894) Marshall Howe did not collect any bryophytes there (Howe 1899). Jepson did collect *Fissidens limbatus* Sull. (= *F. crispus* Mont.) lower down in the Napa Valley in 1893. Howe in 1894 collected *Antitrichia californica* Sull. ex Lesq., in St. Helena. J.P. Tracy followed with a collection in 1903. During 1907, L.L. Lyman, of Bale Mill fame, collected *Antitrichia californica* Sull. ex Lesq., *Dicranella howei* Renauld & Cardot, *Epipterygium tozeri* (Grev.) Lindb., *Homalothecium nuttallii* (Wilson) A.Jaeger, *H. pinnatifidum* (Sull. & Lesq.) E.Lawton, *Isothecium spiculiferum* (Mitt.) Renauld & Cardot, *I. stoloniferum* Brid., and *Syntrichia princeps* (DeNot.) Mitt., depositing them at NY. W.H. Wagner and F.V. Ranzone in 1946, followed by Leo F. Koch during 1947–1954, collected numerous mosses within Napa County. I obtained label data for the above collections from the Consortium of North American Bryophyte Herbaria (CNABH 2020). The many mosses collected within Sonoma County by Ron Robertson reside within boxes at UC, awaiting curation (B. Mishler, UC, personal communication). Although Robertson may have included Napa County within his area of collecting, the author was not able to determine during this study since the specimens are not accessioned. See the catalogue for species assignation

to family, location of referenced herbarium specimens, and resolution of historical misidentifications and pertinent nomenclatural and taxonomic information.

METHODS

Compiling species for the catalogue of Napa County mosses began with a search of publications and herbarium records, augmented by my collections during 1968–2018, and ended in discovery and examination of collections in herbaria.

Starting in 1971, I assembled a list of potentially occurring taxa by searching published North American moss floras (Flowers 1973; Grout 1903–1910, 1928–1941; Koch 1950, 1954; Lawton 1971, Norris and Shevock 2004a), pertinent regional floras (Whittemore 2020), and unpublished checklists (D. Norris, UC, personal communication; M. Hartill, POM, personal communication); W. Schofield, UBC, personal communication) to note which taxa were reported in California (especially Napa County), corresponded with bryologists to request comments on the several iterations of the preliminary list (Rae 1975, 1976, 1977, 1980), and then conducted direct herbarium searches at University of California, Berkeley (UC), University of California, Davis (DAV), California Academy of Sciences (CAS), Los Angeles Museum of Natural History (LAM now housed at UC), Rancho Santa Ana Botanic Garden (California Botanical Garden) (RSA), and Humboldt State University (HSC) to locate existing specimens collected in Napa County. Following the development of the internet and at the dawn of digitized herbarium collections, I queried online databases to discover collections deposited at reporting herbaria. I completed online searches of all U.S. herbaria that are currently included in the Consortium of North American Bryophyte Herbaria (2020). I copied herbarium labels at UC during 1975–1980, and received copies of CAS holdings (J. Shevock, CAS, personal communication). Digital lists of taxa and copies of selected collection labels were obtained from ILL and NY, also in 2020.

I collected extensively throughout 1975 and 1976 within the Napa Valley and less systematically throughout other portions of Napa County (Fig. 1) beginning in 1968. The Napa River watershed collections were a component of my doctoral dissertation research (Rae 2006). I chose collection sites to sample the various habitats and microhabitats throughout Napa County. However, due to the diverse area involved and the pattern of public-private ownership, Napa County coverage was neither systematic nor complete.

Specialists collaborated in identifying many collections. Several collections were reexamined, and identifications were confirmed where ambiguity existed. I also examined collections by others held at various herbaria (CAS, ILL, NY, and UC). James Shevock identified many collections while I worked

on my dissertation research (Rae 2006). David Toren assisted in identifying or confirming determinations of about 1/3 of the catalogued species. David Toren, James Shevock, and I examined specimens already deposited at CAS and UC. I also solicited identifications from other bryologists and these determinations are reported in the catalogue where applicable. When necessary, I requested loans from ILL and NY to verify collection existence and determination (e.g., *Grimmia manniae* Holz.). I identified collections using a variety of moss keys and books, most notably: *Flora of North America North of Mexico* (Flora North America Editorial Committee 2007, 2014), and others (Lawton 1971; Schofield 1992; Norris and Shevock 2004b; Malcolm et al. 2009).

Finally, I entered determinations into a digital database to facilitate data evaluation and retrieval. The catalogue displays the results of the identification process. The catalogue entry for each species separately reports the number of collections by me and others. I deposited vouchers of cited specimens at California Academy of Sciences (CAS) and University of California, Berkeley (UC). The catalogue includes only a subset of collections known within Napa County, those will be made available via the Consortium of North American Bryophyte Herbaria after their deposition in herbaria (CAS and UC). I have retained a reference collection to support additional research on the Napa County moss flora. Within the catalogue, I include numbers of collections, numbers of collection locations and an assessment of rarity for each species.

RESULTS AND DISCUSSION

The catalogue includes 158 moss species within 77 genera and 31 families that are reported or confirmed to occur within Napa County (see catalogue below). The confirmed reports are based on examination of cited collections by David Toren, James Shevock, and me. Cited collections are deposited in California Academy of Sciences, San Francisco (CAS) and University of California, Berkeley (UC). Two species are included in the catalogue although their collection packets (at ILL) have not been examined. I made 1553 collections; other collectors made 147. I collected 87 species not collected by others. Eleven species in the catalogue were not collected by me, while 59 species are in common among other collectors. I was not able to re-collect 10 species reported earlier (1866–1997) which represent misidentifications or reports that are highly suspect where habitat is lacking for them.

Seven species are excluded from catalogue consideration. Several of these species were misidentified, some have been renamed, and others are of undetermined status due to incomplete collection information (see catalogue for additional information).

Examining the number of collection sites for each species permits an assessment of categories of

possible rarity and distribution. The four categories (rare: 0–2, uncommon: 3–5, common: 6–19, abundant: 20 or more) are not intended to correspond to categories established within other systems (California Native Plant Society 2020). As is obvious from the distribution of collection locations (Fig. 1), a significant portion of Napa County remains to be collected. However, at this time, it is appropriate to conclude that 124 species are rare or uncommon. More than a few of these are small and acrocarpous in form and may have been overlooked during early collecting visits. It may be that a more systematic search would yield additional locations. Meanwhile, although the collection dates are not reported here, an examination of the earliest collections shows that they are clustered. That suggests that moss collecting by others may have been a secondary purpose during a visit. In fact, Willis Lynn Jepson's moss collections across the northern portion of Napa County seems to have been a minor component of his more extensive vascular plant collections during visits within western Yolo, northern Napa, and southern Lake counties. Also, Lyman's collections in 1907 are clustered just north of St. Helena around his commercial flour mill (Bale Mill).

It is likely that additional species as yet undocumented may occur within Napa County. I note that 22 species have been confirmed at only one or two locations. These numbers suggest that Napa County is not yet saturated in terms of bryological surveys and collections. But curiously, the trendline for numbers of mosses confirmed over the years within Napa County parallels that for vascular plants during a similar period (Rae 2006). Perhaps neither group has been fully documented with collections obtained by detailed surveys.

My other collections were conducted over a long period (1970–2018) primarily on private lands where access was granted. Some collections were gathered from California state-owned lands under permit. Although an attempt to collect within the various habitats was attempted, this catalogue does not represent a systematic effort to sample the moss flora of Napa County. There is a maritime influence affecting different portions of Napa County that have different precipitation patterns. The resultant summer fog may influence the distribution of mosses within Napa County. According to Azevedo and Morgan (1974), forest epiphytes and understory plants would benefit from an increased nutrient catch due to summer fog. There are three avenues along which fog enters Napa County: from Sonoma County to the west through the gap in the Mayacamas Mountains southwest of Mt. St. Helena, from Solano County to the east over the gap in the low hills immediately north of Mt. Vaca, and from the south over San Francisco Bay and the City of American Canyon up to and bounded by Soscol Ridge. In addition, low clouds of the maritime influence shroud the upper portions of the hills surrounding the central and southern portions of the

Napa Valley. These additional water sources may influence local moss species distributions along topographic and elevational gradients.

The mosses confirmed within Napa County represent 24% of the approximate 657 moss taxa known from the State of California (Norris and Shevock 2004a, J. Shevock, CAS, personal communication). Clearly, many Californian bryophytes occur mainly in high mountains, deserts, or the wet areas in other areas of California; in many cases it is unlikely that these would occur within Napa County. However, a discussion of how the occurrence and abundance of mosses within Napa County compares to other areas and the state of California must wait until more information is available for comparison. For now, comparing the moss species reported in Napa County by Whittemore (2020) with those in the catalogue reveals a significant increase. The trend reflects increased collection activities, while the actual numbers probably reflect the varying level of effort. In the San Francisco Bay Area there are three county and one state park moss catalogues available: Marin (Yurky 1990, 1995), Mt. Diablo (Hutton et al. 2021), Napa (present work), and San Francisco (Shevock and Toren 2001). Nearby are two more: Lake County (Toren 2015), and Santa Cruz County (Kellman 2003). Recent interest has resulted in the development of this and other catalogues and a push for more bryophyte publications for other California areas (J. Shevock, CAS, personal communication). Another increase in information is anticipated once the long-term collections by Ron Robertson in Sonoma County are curated at UC (B. Mishler, UC, personal communication). A discussion on the significance of occurrences within Napa County, for most species, is premature before these and other local catalogues are made available for comparison (Shevock 2003).

In 2009, Whittemore included 288 taxa in a printed, unpublished key to the mosses of the 10 counties that are closest to San Francisco Bay, including Contra Costa County (Whittemore 2009); my Napa County total of 158 represents more than half of these taxa. Just to the north of the Bay Area, a thorough list of mosses has been published for Lake County by Toren (2015). Lake County has an area of about 3253 km², excluding lake surfaces. It is contiguous to the northern boundary of Napa County and its maximum elevation is 2150 m. Lake County currently has 302 documented moss taxa (D. Toren, CAS, personal communication), meaning that Napa County, with less elevation, has slightly more than half the known number of moss taxa compared to Lake County. The significance of this comparison is not clear because the collection methods are not similar, the areas were not systematically covered, and generalized habitat descriptions frustrate their comparison.

Several unusual vascular plant species with limited distribution and low abundance are reported in Napa County (California Native Plant Society 2020), but no moss species to date. I can now report several mosses

worthy of consideration. Newly reported in Napa County, *Grimmia mariniana* Sayre is uncommon elsewhere and endemic to western California. Also, *Bryum lanatum* (P.Beauv.) Brid., is reported for Napa County, although previously found primarily in Sierra Nevada and only recently recorded from the Coast Ranges at Mount Diablo (D. Hutton, personal communication). Comparing bryophytes to vascular plants, Carter et al. (2016) stated that endemism in mosses is not found frequently, so a lack of species unique or endemic to Napa County is expected. Thus, the reporting of mosses at one or two locations within Napa County may be a function of collection methodology rather than actual distribution. However, the low number of collectors has left an uneven record of mosses in Napa County. For instance, several mosses abundant in apparently comparable habitats around the state (*Alsia californica* (Hook. & Arn.) Sull., *Claopodium whippleanum* (Sull.) Renauld & Cardot, *Didymodon vinealis* (Brid.) R.H.Zander, *Grimmia lisae* DeNot., and *Grimmia trichophylla* Grev.) were not previously collected in Napa County. However, I made many collections of each. Further, Napa County collections that are systematically placed to sample the numerous variable and fragmented habitats (and microhabitats) in Napa County may clarify the unique or ubiquitous distribution of infrequently encountered moss species.

Richerson and Lum (1980) suggest that explaining diversity patterns is complex and difficult. Some of the problems are methodological. Data sets of the requisite accuracy and independence of controlling variables to approximate good experiments will not be easy to construct. Deeper problems stem from diversity patterns being generated by complex environmental variables strongly influenced by the biology of the organisms in question. It seems likely that explaining patterns with simple causal hypotheses will always be inadequate. Diversity patterns appear to require sophisticated and detailed hypotheses that take into account the complexity of organismic interactions with the environment.

Given the diverse habitats throughout Napa County, and that the distribution of mosses is probably much influenced by micro-habitat features, it is expected that a more intensive survey of Napa County should discover additional moss species. In addition, since Napa County is an acknowledged hot spot for special status vascular plants, it is not unreasonable to anticipate discovering more mosses at the limits of their distribution range. And, perhaps, species unique to this portion of the North Coast Ranges. Significant effort still needs to be committed to better understand the moss flora of Napa County.

CATALOGUE OF MOSSES CONFIRMED FROM NAPA COUNTY

The 158 species are presented alphabetically by genus and species with the family assignation in

parentheses, consistent with Flora of North America Editorial Committee (2007, 2014). Nomenclature follows TROPICOS (2020). The listed name may differ from that for the same taxon cited by the Flora of North America Editorial Committee (2007, 2014). Cited collections include a subset of 1554 collected by the author and 89 by others. For each species the number of collections by the author is indicated separately from the number collected by others (e.g., Rae 66, others 3).

Six hundred twenty-five (625) collections were obtained within quadrats sampled for my doctoral dissertation research within the Napa River watershed (Rae 2006). The numbers for those early collections have recently been re-numbered to reflect a numerical sequence rather than separate local area sequences. Some collections distributed by the author prior to 2019 and deposited in herbaria may reflect obsolete schema reflecting local area sequences. Thus, reference to those earlier numbers will confuse comparison with current numbers.

Next, I give an assessment of the abundance of the species in Napa County, using one of four categories: rare, uncommon, common, or abundant. This assessment refers only to Napa County and the locations where sampled and in no way reflects rarity in California as a whole, or elsewhere. I also note that the categories are rough estimates, based only on the number of collections and observations reported herein. Clearly, small or ephemeral species are likely to be found less easily than large showy ones, and this introduces bias into the estimate. Similarly, some species may appear under-collected because they are restricted to specialized habitats or may be common only within suitable sites. Given these caveats, I cite a species as rare if it has only one or two locations or all collections at one location, uncommon if it has three to five collection locations, common if I know of six to 19 collection locations, and abundant if I know it from >20 separate collection locations. Location information is based on label data from cited collections, listed references, and my additional collections not cited in the catalogue. Location information for each species is summarized from collection labels. Information from each collection is not included here. I next list individual collections, collector and collection number, and herbarium abbreviation where the specimen is deposited. After the main list, I note species reported as occurring in Napa County for which their occurrence may be doubted, for reasons given in each case.

Cited collections by the author are deposited in regional research herbaria: California Academy of Sciences (CAS), University of Illinois (ILL), and University of California, Berkeley (UC). However, in this catalogue, all of the Rae collections are at CAS unless otherwise indicated. These cited collections are each referenced by the pertinent herbarium abbreviation. Information on cited collections by others was obtained from several herbaria (indicated by their

codes): Additional collections providing information on distribution and abundance (not cited here) are deposited at CAS, University of California, Davis (DAV), and UC. I have retained selected materials in a personal reference collection.

Historical references citing collections or observations recorded within Napa County are listed where pertinent. Several taxa were collected over the years within Napa County but are not represented by recent collections. *Leptodictyum riparium* (Hedw.) Warnst., was collected by Joseph P. Tracy in 1903 at the edge of a pond near Calistoga. The collection site cannot be relocated from label information due to landscape changes. This could be the first documented moss extirpated from Napa County. Some mosses have been collected only once. *Fissidens pauperculus* M. Howe was reported in Napa County (Koch 1951), but a collection was not cited. A very small moss, it is anticipated to be collected when more intensive field surveys are conducted.

Tortula brevipes (Lesq.) Broth., *Schistidium apocarpum* (Hedw.) Bruch & Schimp. var. *gracile* (Röhl.) Bruch & Schimp., *Grimmia mannii* Holz., are reported in the Consortium of North American Bryophyte Herbaria (2020) as collected in Napa County in 1889 and 1886 but were not collected more recently. *Tortula brevipes* is common elsewhere in California so not being collected more recently suggests either a misidentification or an error in location data. *Schistidium apocarpum* var. *gracile* as a previously misunderstood taxon which has been recently placed within another species. A recent loan of the two 1886 specimens from NY has revealed that the Mann collections both are *Schistidium splendens* T.T.McIntosh, H.H.Blom, D.R.Toren & Shevock. Also, *Grimmia mannii* was collected in that mixture at Soda Springs by Martha Mann in 1886. Originally named by Holzinger (1901) the species was confused with *Grimmia ovalis* (Hedw.) Lindb., and *Grimmia tergestina* Tømm. (Lawton 1971; Hastings 2008). *Grimmia mannii* has long been placed as a synonym of *G. caespiticia* (Brid.) Jur. Recent examination of this fragmentary collection by David Toren suggests that it is more likely *Grimmia alpestris* (F.Weber & D.Mohr) Schleich.. *Orthotrichum texanum* Sull., was collected in Napa County (Koch 2126 ILL) but has been later identified as *Orthotrichum rupestre* Schleich. ex Schwägr., by D. Crane at ILL (L. Minnaert-Grote, ILL, personal communication 2020). The name *Bartramia stricta* Brid. was misapplied (it is a South American moss limited to the Patagonia area); these collections have been assigned to *Bartramia aprica* Müll. Hal. (Müller 2014). Similarly, *Brachythecium bolanderi* (Lesq.) A. Jaeger collections have been transferred to a new genus, *Koponeniella bolanderi* (Lesq.) Huttunen & Ignatov (Huttunen et al. 2015).

An early L.F. Koch collection of *Fontinalis neomexicana* Sull. & Lesq. (Koch 1363), is reported to be at ILL (Consortium of North American Bryophyte Herbaria 2020). However, this collection

is assumed to be still among unaccessioned materials since it could not be located by staff (L. Minnaert-Grote, ILL, personal communication). Unable to confirm the existence of this collection, I decided to exclude the species from the catalogue pending future efforts to accession the ILL backlog.

David Toren and James Shevock have assisted in the confirmation of identifications or provided determinations of many collections (those deposited at CAS). Several collections were previously identified by other knowledgeable bryologists. I have examined these and agree with their determinations. I have examined the collections at UC and agree with their determinations. Although I have not examined the collections at TENN, I accept the determinations by their collectors.

Acaulon rufescens A.Jaeger (Pottiaceae). (Rae 2, others 0).

Rare, two locations. On soil and rock within Napa River watershed along Kortum Canyon Road, on Soscol Ridge. *Rae 1102, 1389* (CAS).

Alsia californica (Hook. & Arn.) Sull. (Leptodontaceae). (Rae 33, others 0).

Abundant, thirty-three locations. On rock (rarely serpentine) and wood throughout Napa River watershed, in Pope Valley. *Rae 1060, 1132, 3008, 3233* (CAS), *Rae 3556* (CAS, UC).

Amblystegium juratzkanum Schimp. (Amblystegiaceae). (Rae 1, others 0).

Rare, one location; on soil in duff layer within mixed evergreen forest understory in northern Mayacamas Mountains. *Rae 1416* (CAS).

Amphidium californicum (Hampe ex Müll.Hal.) Broth. (Rhabdoweisiaceae). (Rae 0, others 1).

Rare, one location. Along Monticello Road. *Koch 1365* (UC).

Anacolia baueri (Hampe) Paris (Bartramiaceae). (Rae 12, others 0).

Common, nine locations. On rock and soil throughout Napa River watershed and Pope Valley. *Rae 137, 205, 626, 1377, 3406* (CAS).

Anacolia menziesii (Turner) Paris (Bartramiaceae). (Rae 16, others 2).

Common, 13 locations. On soil and rock at mid to higher elevations around Napa Valley and Pope Valley and on Mt. St. Helena. *Norris 48267* (UC), *Rae 208, 862, 919, 2987, 3137* (CAS), *Schofield & Thomas 29036* (FLAS).

Antitrichia californica Sull. ex Lesq. (Leucodontaceae). (Rae 59, others 9).

Abundant, 55 locations. Mostly on rock and wood, some soil, sometimes within watercourse channels throughout Napa County at all elevations. *Howe s.n.* (UC), *Hutchison s.n.* (UC), *Koch 2339* (UC), *Lyman s.n.* (UC); *Rae 2861B* (CAS), *Shevock 29851* (CAS); *Shevock, Burge & Penneys 44636* (CAS).

Antitrichia curtispindula (Hedw.) Brid. (Leucodontaceae). (Rae 0, others 1).

Rare, one location. St. Helena area. *Lyman s.n.* (UC).

Archidium crassicostatum D.R.Toren, Kellman & Shevock (Archidiaceae). (Rae 6, others 0).

Rare, two locations. On soil on Soscol Ridge and south end of Howell Mountain Road. *Rae 639A, 2853, 2847* (CAS). Historical reference: Toren et al. (2016).

Atrichum selwynii Austin (Polytrichaceae). (Rae 8, others 0).

Common, seven locations. On soil under or at edge of forest canopy. *Rae 343, 388, 1436, 1478, 2948* (CAS).

Aulacomnium androgynum (Hedw.) Schwägr. (Aulacomniaceae). (Rae 3, others 1).

Uncommon, four locations. On rock and wood at mid-elevation along widely scattered spots around Napa Valley and Pope Valley. *Rae 170, 687, 2674* (CAS).

Barbula convoluta Hedw. (Pottiaceae). (Rae 1, others 0).

Rare, one location. On rock along Oat Hill Mine Road. *Rae 672* (CAS).

Bartramia aprica Müll.Hal. (Bartramiaceae). (Rae 4, others 0).

Uncommon (very little observed at each location), four locations. On rock along Soscol Ridge and along Howell Mountain Road near intersection with Silverado Trail, and on soil on mid-elevation slopes along northeastern Napa Valley. *Rae 641, 1095, 1223, 3134* (CAS).

Bestia longipes (Sull. & Lesq.) Broth. (Lembophyllaceae). (Rae 4, others 1).

Uncommon, four locations. On rock and wood, widely scattered around Napa Valley hillsides and on Howell Mountain. *Rae 382, 571, 861, 3448* (CAS), *Shevock 29852* (CAS, MO, NY, DUKE, WTU). Historical reference: Norris and Shevock (2004a).

Blindia acuta (Hedw.) Bruch & Schimp. (Seligeriaceae). (Rae 2, others 0).

Rare, one location. On soil and rock at mid-elevation along Diamond Mountain Road. *Rae 2934, 2940* (CAS).

Brachytheciastrum collinum (Schleich. ex Müll.Hal.) Ignatov & Huttunen (Brachytheciaceae). (Rae 3, other 0).

Uncommon, three locations. On soil and rock in Skyline Regional Park, along ridge northwest end of Howell Mountain, and northwest of Lake Berryessa. *Rae 851, 2604, 2962* (CAS).

Brachytheciastrum velutinum (Hedw.) Ignatov & Huttunen (Brachytheciaceae). (Rae 10, others 1).

Common, seven locations. On soil, rock and wood around the Napa River watershed on mid-elevation

slopes, on Mt. St. Helena. *Rae* 1208, 1477, 1606, 3551, 3552 (CAS).

Brachythecium albicans (Hedw.) Schimp. (Brachytheciaceae). (Rae 1, others 0).

Rare, one location. On soil along Wild Horse Valley Road. *Rae* 173 (CAS).

Bryolawtonia vancouveriensis (Kindb.) D.H.Norris & Enroth (Neckeraceae). (Rae 3, others 1).

Rare, two locations. On soil on Soscol Ridge and at Highway 29 summit on Mt. St. Helena. *Rae* 852, 2955 (CAS), *Shevock* 29853 (CAS).

Bryum argenteum Hedw. (Bryaceae). (Rae 9, others 0).

Common, seven locations. Mostly on soil and on rock throughout Napa Valley to mid-elevation on Mt. St. Helena. *Rae* 611, 871, 2674, 3353, 3405 (CAS).

Bryum lanatum (P.Beauv.) Brid. (Bryaceae). (Rae 3, others 0).

Uncommon, three locations. On soil in Napa Valley. *Rae* 191, 619, 2609 (CAS).

Bucklandiella affinis (Schleich. ex F.Weber & D.Mohr) Bedn.-Ochyra & Ochyra (Grimmiaceae) (Rae 4, others 0).

Uncommon, four locations; Oat Hill Mine Road, Bothe-Napa Valley State Park; on rock and wood; *Rae* 652A, 678, 887, 901A (CAS).

Bucklandiella occidentalis (Renauld & Cardot) Bedn.-Ochyra & Ochyra (Grimmiaceae). (Rae 0, others 1).
Rare, one location. Along Aetna Springs Road. *O'Brien* 3042 (UC).

Ceratodon purpureus (Hedw.) Brid. (Ditrichaceae). (Rae 19, others 1).

Abundant, 15 locations. Mostly on soil and rock, some on wood at mid-elevation slopes around Napa Valley and Pope Valley. *Koch* 1351 (UC), *Rae* 2840, 3236, 3240, 3391, 3437 (CAS).

Ceratodon stenocarpus Bruch & Schimp. (Ditrichaceae). (Rae 9, others 0).

Uncommon, five locations. On soil along northern Mayacamas Mountains, Oat Hill Mine Road, and Howell Mountain Plateau. *Rae* 675, 692, 698, 915A, 2670 (CAS).

Claopodium bolanderi Best (Leskeaceae). (Rae 1, others 0).

Rare, one location. On wood along ridge at end of Diamond Mountain Road. *Rae* 815 (CAS).

Claopodium crispifolium (Hook.) Renauld & Cardot (Leskeaceae). (Rae 1, others 0).

Rare, one location. On rock along Kortum Canyon Road. *Rae* 1454 (CAS).

Claopodium whippleanum (Sull.) Renauld & Cardot (Leskeaceae). (Rae 32, others 1).

Abundant, 20 locations. On soil, rock and wood at mid-slope hillsides around Napa Valley and Pope Valley, some aquatic. *Rae* 2617, 2998, 3138, 3554 (CAS), *Shevock* 29850 (CAS, MO, NY).

Codriophorus acicularis (Hedw.) P.Beauv. (Grimmiaceae). (Rae 1, others 0).

Rare, one location. On rock, aquatic, at Las Posadas State Experimental Forest. *Rae* 3476 (CAS).

Crumia latifolia (Kindb.) W.B.Schof. (Pottiaceae). (Rae 2, others 0).

Rare, two locations. On soil and partly aquatic on rock; Mayacamas Mountains. *Rae* 551, 1151 (CAS).

Dannorrisia bigelovii (Sull.) Enroth (Neckeraceae). (Rae 13, others 1).

Common, 10 locations. On soil, rock and wood, sometimes aquatic, under mostly shaded forest canopy around Napa County. *Rae* 525A, 854, 1451, 3004 (CAS), *Shevock* 29857 (CAS, MO, NY).

Dendroalsia abietina (Hook.) E.Britton ex Broth. (Cryphaeaceae). (Rae 58, others 5).

Abundant, 38 locations. On tree limbs and trunks, rarely on rock, throughout Napa County. *Lyman s.n.* (UC), *Rae* 3497, 3560C (CAS), *Shevock* 29847 (CAS); *Shevock & Raiche* 11851 (CAS). Historical reference: Manuel (1974).

Dicranella heteromalla (Hedw.) Schimp. (Dicranaceae). (Rae 1, others 0).

Rare, one location. On soil along Kortum Canyon Road. *Rae* 1445 (CAS). Historical reference: Howe (1896).

Dicranella howei Renauld & Cardot (Dicranaceae). (Rae 3, others 1).

Uncommon, four locations. On soil and rock, sometimes aquatic along Soscol Ridge and Mayacamas Mountains. *Lyman s.n.* (UC), *Rae* 1096, 1147, 1396 (CAS). (In other treatments viewed as a synonym of *Dicranella varia* (Hedw.) Schimp. (Flora of North America Editorial Committee 2007).

Dicranella rufescens (Dicks.) Schimp. (Dicranaceae). (Rae 1, others 0).

Rare one location. On soil on Mt. St. Helena. *Rae* 1206 (CAS).

Dicranella varia (Hedw.) Schimp. (Dicranaceae) (Rae 4, others 0).

Uncommon, four locations. On soil and wood at mid-elevation slopes within forest understory, along Kortum Canyon Road, at Las Posadas Experimental Forest and along northwestern Pope Valley. *Rae* 339, 348, 816, 3309 (CAS).

Dicranoweisia cirrata (Hedw.) Lindb. ex Milde (Dicranaceae). (Rae 39, others 4).

Abundant, 36 locations. On wood, rarely on rock, on Mt. St. Helena and throughout Napa Valley and Pope Valley. *Hutchison* 903 (UC), *Koch* 1394 (UC); *Norris* 48251 (UC), *Rae* 3317, 3371 (CAS).

Dicranum tauricum Sapjegin (Dicranaceae). (Rae 0, others 1).

Rare, location unknown. Habitat and site unknown although this species is frequently found on rotten logs, stumps or tree based in woodlands, sometimes on humus (Flora North America Editorial Committee 2007). *Koch 3610* (ILL). (specimen not examined).

Didymodon brachyphyllus (Sull.) R.H.Zander (Pottiaceae). (Rae 4, others 0).

Uncommon, three locations. On soil and rock (sandstone and serpentine), aquatic on serpentine and some sandstone at Oat Hill Mine Road, Cedar Valley and Zinfandel Lane at Napa River. *Rae 677, 932, 1352, 1354* (CAS).

Didymodon eckeliae R.H.Zander (Pottiaceae). (Rae 5, others 1).

Uncommon, five locations. On soil, rock and wood, on Howell Mountain Plateau and hills and valleys east side of Napa Valley. *Rae 234, 1236, 1351, 1371, 3382* (CAS).

Didymodon insulanus (DeNot.) M.O.Hill (Pottiaceae). (Rae 1, others 0).

Rare, one location. On soil along Wild Horse Valley Road. *Rae 375* (CAS).

Didymodon nicholsonii Culm. (Pottiaceae). (Rae 5, others 2).

Uncommon, four locations. On soil, rock and wood, some aquatic on rock, on hillsides around Napa Valley, Snell Valley. *Rae 1237, 3298, 3299* (CAS), *Shevock, Burge & Penneys 44644, 44645* (CAS).

Didymodon norrisii R.H.Zander (Pottiaceae). (Rae 1, others 2).

Rare, two locations. On rock at higher elevations along north and east side of Napa Valley. *Rae 1379* (CAS), *Shevock, Burge & Penneys 44629, 44642* (CAS).

Didymodon tophaceus (Brid.) Lisa (Pottiaceae). (Rae 4, others 2).

Uncommon, five locations. On soil and rock slopes around Lake Berryessa and Knoxville. *Norris 48255* (UC), *Rae 874, 925C, 935, 1801* (CAS). Historical reference: Norris and Shevock (2004a).

Didymodon vinealis (Brid.) R.H.Zander (Pottiaceae). (Rae 44, others 1).

Abundant, 28 locations. On soil, rock (sometimes serpentine) and wood throughout Napa County. *Rae 209, 225A, 344, 1336, 3360* (CAS).

Ditrichum ambiguum Best (Ditrichaceae). (Rae 3, others 0).

Rare, two locations. On soil along northern Mayacamas Mountains and Mt. St. Helena. *Rae 2671, 3114* (CAS).

Ditrichum schimperi (Lesq.) Kuntze (Ditrichaceae). (Rae 6, others 0).

Uncommon, three locations. On soil on Soscol Ridge, and along northern Mayacamas Mountains

and Mt. St. Helena. *Rae 1081, 1766A, 3472, 3474, 3475* (CAS).

Encalypta rhaptocarpa Schwägr. (Encalyptaceae). (Rae 2, others 0).

Rare, two locations. On soil, partially aquatic, along Oat Hill Mine Road. *Rae 879, 1720* (CAS).

Encalypta vulgaris Hedw. (Encalyptaceae). (Rae 1, others 0).

Rare, one location. On soil along Wild Horse Valley Road. *Rae 378* (CAS).

Entosthodon californicus (Sull. & Lesq.) H.A.Crum & L.E.Anderson (Funariaceae). (Rae 2, others 0).

Rare, two locations. On soil mid-slope east of St. Helena. *Rae 632, 1338* (CAS).

Ephemerum serratum (Schreb. ex Hedw.) Hampe (Ephemeraceae). (Rae 1, others 0).

Rare, one location. On thin soil over rock along Soscol Ridge. *Rae 3243* (CAS).

Epipterygium tozeri (Grev.) Lindb. (Mielichhoferiaceae). (Rae 6, others 4).

Common, nine locations. On soil along Mayacamas Mountains, at Mt. St. Helena, and around Howell Mountain Plateau and Mt. George. *Lyman s.n.* (UC) (as *Pohlia tozeri* Grev.), *Rae 1207, 1693, 3550* (CAS).

Fabronia ciliaris (Brid.) Brid. (Fabroniaceae). (Rae 2, others 0).

Rare, two locations. On wood along southeastern slope of Mt. St. Helena and just east of Saint Helena. *Rae 1219, 1330* (CAS).

Fabronia pusilla Raddi (Fabroniaceae). (Rae 3, others 3).

Uncommon, five locations. On wood in City of Napa and Howell Mountain Plateau. *Norris 48237, 48265* (UC), *Rae 218, 899, 3132* (CAS).

Fissidens adianthoides Hedw. (Fissidentaceae). (Rae 1, others 0).

Rare, one location. On soil along Diamond Mountain Road. *Rae 2950* (CAS).

Fissidens bryoides Hedw. (Fissidentaceae). (Rae 4; others 3).

Common, seven locations. On soil and rock, sometimes aquatic, on hillsides along east side of Napa Valley, in Wild Horse Valley. *Norris 48249* (UC), *Rae 138, 211, 226, 254* (CAS).

Fissidens crispus Mont. (Fissidentaceae). (Rae 33, others 3).

Abundant, 29 locations. On soil, rock and wood, throughout Napa Valley, Mt. St. Helena, Howell Mountain Plateau and Wooden Valley. *Jepson s.n.* (UC as *Fissidens limbatus* Sull.), *Rae 567, 898, 1438, 3098, 3444* (CAS).

Fissidens curvatus Hornsch. (Fissidentaceae). (Rae 3, others 1).

Uncommon, four locations. On soil in American Canyon, upper slope east side of Napa Valley, and Wooden Valley. *Rae* 371, 911, 2625 (CAS).

Fissidens fontanus (Bach.Pyl.) Steud. (Fissidentaceae). (Rae 0, others 1).

Rare, one location. No habitat data, northern Mayacamas Mountains. *Koch* 1397 (UC) (as *Octodicerus fontanus* Bach.Pyl.) Lindb.). Historical reference: Koch (1950), Pursell (1987), Norris and Shevock (2004a).

Fissidens sublimbatus Grout (Fissidentaceae). (Rae 4, others 0).

Uncommon, four locations. On soil and rock along Soscol Ridge and hillsides around Napa Valley. *Rae* 690B, 1065, 2854, 3545 (CAS).

Fissidens taxifolius Hedw. (Fissidentaceae). (Rae 1, others 0).

Rare, one location. On rock at Skyline Regional Park. *Rae* 852 (CAS).

Fontinalis antipyretica Hedw. (Fontinalaceae). (Rae 4, others 1).

Uncommon, four locations. On rock, aquatic in watercourses along east side of Napa Valley. *Koch* 1399 (ILL), *Rae* 366, 1384, 2579, 2580 (CAS).

Frisvollia varia (Mitt.) Sawicki, Szczecińska, Bedn.-Ochyra & Ochyra (Grimmiaceae). (Rae 1, others 0). Rare, one location. On rock at Linda Falls on Howell Mountain Plateau. *Rae* 3488 (CAS).

Funaria hygrometrica Hedw. (Funariaceae). (Rae 18, others 0).

Common, 16 locations. On soil and rock, and in disturbed areas in American Canyon, throughout Napa Valley and Pope Valley. *Rae* 675B, 701, 875A, 1122, 1360 (CAS).

Gemmabryum brassicoides J.R.Spence & Kellman (Bryaceae). (Rae 1, others 0).

Rare, one location. On rock along Silverado Trail just south of Pope Street Bridge. *Rae* 1335 (CAS).

Gemmabryum californicum (Sull.) J.R.Spence (Bryaceae). (Rae 2, others 0).

Rare, two locations. On rock along Silverado Trail just south of Pope Street Bridge, Soda Canyon Road; on rock. *Rae* 1337, 1364 (CAS).

Gemmabryum dichotomum (Hedw.) J.R.Spence & H.P.Ramsay (Bryaceae). (Rae 1, others 0).

Rare, two locations. On rock along Dry Creek Road. *Rae* 573 (CAS).

Gemmabryum gemmilucens (R. Wilczek & Demaret) J.R.Spence (Bryaceae) (Rae 1, others 1).

Rare, two locations. On soil along Soscol Ridge and in lawn at Crane Park in St. Helena. *Norris* 48240 (UC as *Bryum gemmilucens* R. Wilczek & Demaret); *Rae* 1100 (CAS).

Gemmabryum kunzei (Hornsch.) J. R. Spence (Bryaceae). (Rae 4, others 0).

Rare, two locations. On rock in Napa and Snell Valley. *Rae* 915, 3300, 3304, 3305 (CAS).

Gemmabryum valparaisense (Thér.) J.R.Spence (Bryaceae). (Rae 1, others 0).

Rare, one location. On rock, along Soda Canyon Road at summit. *Rae* 1380 (CAS).

Grimmia alpestris (F.Weber & D.Mohr) Schleich. (Grimmiaceae). (Rae 0, others 1).

Rare, one location. No habitat data, at old Soda Springs Resort (Napa Soda Springs); *Mann s.n.* (NY as *Grimmia torenii* Hastings). Few specimens in an 1886 mixture of *Grimmia* sp. collected by Marilyn Mann originally labelled as a new species (*Grimmia mannii* Holz.) by C. Müller (1887) and cited as *G. manniae* Holz. in TROPICOS (2020). In a confusing paper, Holzinger (1901) unsuccessfully clarified its separation from *Grimmia holzingeri* Cardot & Thériot. Thought to be *Grimmia caespiticia* (Brid.) Jur., by Muñoz (1998). The packet remained at NY until examined by Hastings (2008), but was mistakenly placed in *Grimmia torenii* Hastings. The material is now recognized as *Grimmia alpestris* following Maier (2010) (D. Toren, CAS, personal communication).

Grimmia laevigata (Brid.) Brid. (Grimmiaceae). (Rae 17, others 1).

Common, 13 locations. On rock, rarely aquatic, throughout Napa Valley, Soscol Ridge, Howell Mountain Plateau, Pope Valley, and around Lake Berryessa. *Rae* 625, 825, 2606, 2864 (CAS), *Shevock, Burge & Penneys* 44625 (CAS).

Grimmia lisae DeNot. (Grimmiaceae). (Rae 47, others 0).

Abundant, 34 locations. On soil, rock and wood, rarely aquatic, throughout Napa Valley, Mt. St. Helena, Howell Mountain Plateau, Chiles Valley, Pope Valley. *Rae* 3321, 3418, 3458, 3466, 3503 (CAS).

Grimmia mariniana Sayre (Grimmiaceae). (Rae 6, others 0).

Rare, one location. On rock at Mt. St. Helena summit. *Rae* 3338, 3339, 3340, 3341 (CAS). Historical reference: Sayre (1955), Norris and Shevock (2004a).

Grimmia montana Bruch & Schimp. (Grimmiaceae). (Rae 4; others 1).

Uncommon, three locations. On rock on Mt. St. Helena. *Rae* 395, 1168, 3350 (CAS), *Shevock, Burge & Penneys* 44626 (CAS).

Grimmia ovalis (Hedw.) Lindb. (Grimmiaceae). (Rae 3, others 0).

Uncommon, three locations. On rock, along Wild Horse Valley Road and Howell Mountain Plateau. *Rae* 153, 346, 2868C (CAS).

Grimmia pulvinata (Hedw.) Sm. (Grimmiaceae). (Rae 32, others 1).

Abundant, 16 locations. On rock in Mayacamas Mountains, throughout Napa Valley, Pope Valley, and Howell Mountain Plateau. *Rae* 231, 549, 2620, 2986 (CAS), *Shevock, Burge & Penneys* 44638 (CAS).

Grimmia serrana Muñoz, Shevock, & D.R.Toren (Grimmiaceae). (Rae, 0, others 1)

Rare, one location. On rock on Mt. St. Helena. *Shevock, Burge & Penneys* 44626A (CAS).

Grimmia trichophylla Grev. (Grimmiaceae). (Rae 46, others 2).

Abundant, 29 locations. On rock throughout Napa Valley, Mayacamas Mountains, Howell Mountain Plateau, and Pope Valley. *Rae* 2605, 3090, 3241, 3389 (CAS), *Shevock, Burge & Penneys* 44641 (CAS). Historical reference: Koch (1954).

Hedwigia detonsa (M. Howe) W.R.Buck & D.H.Norris (Hedwigiaceae). (Rae 4, others 2).

Uncommon, three locations. On rock on Mt. St. Helena. *Norris* 48266 (UC), *Rae* 1173, 1193, 1197 (CAS), *Shevock, Burge & Penneys* 44637 (CAS). Historical reference: Norris and Shevock (2004a).

Hedwigia stellata Hedenäs (Hedwigiaceae). (Rae 1, others 0).

Rare, one location. On rock north of Lake Berryessa. *Rae* 931 (CAS).

Hennediella stanfordensis (Steere) Blockeel (Pottiaceae). (Rae 0, others 3).

Rare, one location. On soil in lawn at Crane Park, Saint Helena. *Norris* 48231 (MO), *Norris* 48235 (CAS), *Norris* 48244 (TENN, UC).

Homalothecium arenarium (Lesq.) E.Lawton (Brachytheciaceae). (Rae 28, others 0).

Abundant, 18 locations. On soil, rock, and wood, City of Napa, Mayacamas Mountains, and Howell Mountain Plateau. *Rae* 913, 1346, 1368, 1373, 1381 (CAS).

Homalothecium nevadense (Lesq.) Renauld & Cardot (Brachytheciaceae). (Rae 9, others 1).

Common, nine locations. On soil, rock and wood, along hillsides around Napa Valley, and Howell Mountain Plateau. *Rae* 2849, 2868B, 2935, 2957 (CAS), *Wagner & Ranzoni s.n.* (UC).

Homalothecium nuttallii (Wilson) A.Jaeger (Brachytheciaceae). (Rae 75, others 2).

Abundant, 36 locations. On soil, rock and wood, throughout valleys and hills of Napa County. *Koch* 1387 (UC); *Lyman s.n.* (UC as *Camptothecium nuttallii* (Wilson) Schimp.), *Rae* 565, 572, 1568 (CAS).

Homalothecium pinnatifidum (Sull. & Lesq.) E.Lawton (Brachytheciaceae). (Rae 33, others 2).

Common, 18 locations. On soil, rock and wood, within forested areas around Napa County. *Lyman s.n.* (UC) (as *Camptothecium pinnatifidum* (Sull. & Lesq.) Sull.); *Rae* 2960, 3117, 3229 (CAS), *Shevock, Burge & Penneys* 44640 (CAS, NY).

Imbribryum gemmiparum (DeNot.) J.R.Spence (Bryaceae). (Rae 1, others 1).

Rare, two locations. On rock in watercourses, Ritchie Creek in Bothe-Napa Valley State Park, and on Mt. St. Helena. *Rae* 1464 (CAS); *Shevock, Burge & Penneys* 44631 (CAS, MO, NY).

Imbribryum miniatum (Lesq.) J.R.Spence (Bryaceae). (Rae 4, others 0).

Uncommon, three locations. On rock and wood, aquatic, within mid-elevation small channels in hills on both sides of upper Napa Valley. *Rae* 646, 892, 2613 (CAS). Historical reference: Norris and Shevock (2004a).

Imbribryum torenii J.R.Spence & Shevock (Bryaceae). (Rae 5, others 0).

Uncommon, four locations. On thin soils, along lower slopes around eastern and southeastern edge of Napa Valley, on Mt. St. Helena. *Rae* 168, 622, 870, 1378 (CAS), *Shevock, Burge & Penneys* 44643 (CAS, NY).

Isothecium cristatum (Hampe) H.Rob. (Lembophyllaceae). (Rae 41, others 4).

Abundant, 22 locations; Mt. St. Helena, forested slopes around Napa Valley and Pope Valley; on soil, rock, and wood; *Hutchison* 901 (UC as *Bestia breweriana* (Lesq.) Grout), *Koch* 2110 (UC as *Bestia cristata* (Hampe) L.F.Koch), *Lyman s.n.* (UC as *Tripterocladium brewerianum* (Lesq.) M. Fleisch.), *Rae* 3222 (CAS), *Schofield & Thomas* 29026 (TENN), *Shevock* 29846 (CAS).

Isothecium spiculiferum (Mitt.) Macoun & Kindb. (Lembophyllaceae). (Rae 6, others 1).

Uncommon, five locations. On rock and wood, rarely soil, at Zinfandel Lane at the Napa River, and along the northern Mayacamas Mountains. *Lyman s.n.* (FLAS, UC as *Isothecium stoloniferum* Brid.), *Rae* 1357, 1570, 1592, 1659, 1660 (CAS).

Isothecium stoloniferum Brid. (Lembophyllaceae). (Rae 17, others 4).

Common, eight locations. On soil, rock and wood, rarely in watercourse on rock, along Oat Hill Mine Road, mid to upper slopes of Mayacamas Mountains. *Rae* 3372, 3446 (CAS), *Shevock* 29844 (CAS), *Shevock* 29856 (CAS, MO, NY), *Shevock, Burge & Penneys* 44646 (CAS).

Kindbergia oregana (Sull.) Ochyra (Brachytheciaceae). (Rae 7, others 0).

Uncommon, five locations. On soil, rock and wood under full woody canopy, Mayacamas Mountains. *Rae* 1517, 1611, 1621, 1688, 3003 (CAS).

Kindbergia praelonga (Hedw.) Ochyra (Brachytheciaceae). (Rae 6, others 1).

Uncommon, five locations. On soil, wood and rock, sometimes aquatic, on rocky hillsides around Napa Valley and Howell Mountain Plateau. *Rae* 242, 399, 1653, 1664 (CAS), *Shevock* 29855 (CAS, NO, NY).

Koponeniella bolanderi (Lesq.) Huttunen & Ignatov (Brachytheciaceae). (Rae 1, others 0).

Rare, one location. On wood mid-way along Soda Canyon Road. *Rae 3394* (CAS).

Leptobryum pyriforme (Hedw.) Wilson (Bryaceae). (Rae 3, others 0).

Rare, one location. On soil in garden pots, City of Napa. *Rae 2731* (CAS).

Leptodictyum riparium (Hedw.) Warnst. (Amblystegiaceae). (Rae 0, others 1).

Rare, one location. Aquatic at pond edge, south of Calistoga in the upper Napa Valley. *Tracy 1871* (UC determined by W. Weber, 1960).

Lewinskya rupestris (Schleich. ex Schwägr.) F.Lara, Garilleti & Goffinet (Orthotrichaceae). (Rae 17, others 5).

Common, six locations. On rock, rarely on soil and wood, City of Napa (Cup and Saucer Ridge), Mt. St. Helena, Howell Mountain Plateau and Pope Valley. *Rae 1184, 1194, 3230* (CAS), *Shevock, Burge & Penneys 44623, 44635A* (CAS). Historical reference: Koch (1950).

Neckera menziesii Drumm. (Neckeraceae). (Rae 1, others 1).

Rare, two locations. On rock in Mayacamas Mountains. *Koch 2107* (UC as *Neckeradelphus menziesii* (Drumm.) Steere), *Rae 1690* (CAS).

Niphotrichum elongatum (Ehrh. & Frisvoll) Bedn.-Ochyra & Ochyra (Grimmiaceae). (Rae 3, others 0). Rare, one location. On soil in managed grassland along Soda Canyon Road. *Rae 3413, 3414, 3417* (CAS).

Nogopterium gracile (Hedw.) Crosby & W.R.Buck (Lembophyllaceae). (Rae 85, others 4).

Abundant, 38 locations. On soil, rock and wood throughout Napa County. *Norris 48264* (UC), *Rae 3331, 3449* (CAS), *Shevock 29849* (CAS); *Shevock, Burge & Penneys 44633* (CAS).

Orthotrichum cucullatum F. Lara, R. Medina & Garilleti (Orthotrichaceae). (Rae 1, others 0).

Rare, one location. On wood at Shetler Avenue bridge over Cayetano Creek. *Rae 3543* (CAS).

Orthotrichum cylindrocarpum Lesq. (Orthotrichaceae). (Rae 3, others 0).

Uncommon, three locations. On wood in the City of Napa, on Mt. St. Helena, and along Crystal Springs Road. *Rae 212, 3226, 3367* (CAS).

Orthotrichum norrisii F.Lara, R.Medina & Garilleti (Orthotrichaceae) (Rae 1, others 0).

Rare, one location. On wood at Olive Orchard Day Use Area at Lake Berryessa. *Rae 3499* (CAS).

Orthotrichum rivulare Turner (Orthotrichaceae). (Rae 5, others 0).

Uncommon, five locations. Aquatic on rock, rarely on wood in watercourses, on hillsides around Napa Valley. *Rae 821, 1286, 1462, 1552, 1682* (CAS).

Phascum cuspidatum Schreb. ex Hedw. (Pottiaceae). (Rae 1, others 0).

Rare, one location. On soil in spring runoff of geothermal springs at north end of Calistoga. *Rae 1766H* (CAS).

Philonotis capillaris Lindb. (Bartramiaceae). (Rae 1, others 0).

Rare, one location. On soil in Mayacamas Mountains. *Rae 1149* (CAS).

Philonotis fontana (Hedw.) Brid. (Bartramiaceae). (Rae 0, others 3).

Rare, two locations. On soil in Napa Valley and on Mt. St. Helena. *Koch 1366* (UC); *Shevock, Burge & Penneys 44630* (CAS). Historical reference: Zales (1973).

Physcomitrium pyriforme (Hedw.) Brid. (Funariaceae). (Rae 1, others 0).

Rare, one location. On soil along Soda Creek. *Rae 365* (CAS).

Plagiobryoides renauldii (Röll) J.R.Spence (Bryaceae). (Rae 2, others 0).

Rare, two locations. On soil and rock in Soda Creek channel and watercourse in Wild Horse Valley. *Rae 362A, 363* (CAS).

Pleuridium acuminatum Lindb. (Ditrichaceae). (Rae 18, others 0).

Common, seven locations. On soil, rarely on rock, along Soscol Ridge, throughout Mayacamas Mountains and Howell Mountain Plateau. *Rae 2845, 2852, 2855, 2931, 2939* (CAS).

Pleuridium subulatum (Hedw.) Rabenh. (Ditrichaceae). (Rae 13, others 0).

Common, nine locations. On soil, rarely on rock, rarely aquatic on wood, along Soscol Ridge, Mayacamas Mountains, hillsides on east side of Napa Valley, and Skyline Regional Park. *Rae 1093, 1124, 1221, 1392* (CAS).

Pohlia longibracteata Broth. (Bryaceae). (Rae 1, others 0).

Rare, one location. On rock within rivulet, aquatic, on Mt. St. Helena. *Rae 2123* (CAS).

Polytrichastrum alpinum (Hedw.) G.L.Sm. (Polytrichaceae). (Rae 1, others 0).

Rare, one location. On rock at Soscol Ridge. *Rae 1086* (CAS).

Polytrichum juniperinum Hedw. (Polytrichaceae). (Rae 17, others 1).

Common, 12 locations. On soil, rarely on rock, Soscol Ridge, Mayacamas Mountains, Mt. St. Helena, hills east of Napa Valley, Howell Mountain Plateau, Pope Valley. *Koch 1373* (UC), *2626* (CAS), *Rae 2842, 3312, 3427, 3432, 3459, 3461, 3462* (CAS).

Polytrichum piliferum Hedw. (Polytrichaceae). (Rae 1, others 0).

Rare, one location. On soil, along Soda Canyon Road. *Rae* 3412, 3421 (CAS).

Pseudobraunia californica (Lesq.) Broth. (Hedwigiaceae). (*Rae* 26, others 5).

Common, 19 locations. On rock, rarely on soil, along hillsides and ridges throughout Napa County. *O'Brien* 3039 (CAS), *O'Brien* 3041 (UC), *Rae* 690H, 3420 (CAS), *Shevock*, *Burge & Penneys* 44639 (CAS), *Wagner & Ranzoni s.n.*, *s.n.* (two unnumbered collections), 2338 (UC).

Pseudotaxiphyllum elegans (Brid.) Z.Iwats. (Hypnaceae). (*Rae* 3, others 0).

Uncommon, three locations. On soil, rock and wood, in Mayacamas Mountains, Bothe-Napa Valley State Park. *Rae* 1467, 1618, 1651 (CAS).

Pterigynandrum filiforme Hedw. (Pterigynandraceae). (*Rae* 4, others 0).

Rare, one location. On rock, rarely on wood, along Wild Horse Valley. *Rae* 186, 192 (CAS).

Ptychomitrium gardneri Lesq. (Ptychomitriaceae). (*Rae* 5, others 1).

Uncommon, four locations. On rock; on Mt. St. Helena and hillsides on east side of Napa Valley. *Rae* 905, 1183, 1276, 3398 (CAS), *Shevock*, *Burge & Penneys* 44628 (CAS).

Ptychostomum pseudotriquetrum (Hedw.) J.R.Spence & H.P.Ramsay ex Holyoak & N.Pedersen (Bryaceae). (*Rae* 2, others 1).

Uncommon, three locations. On soil in Wild Horse Valley and Knoxville. *Norris* 48269 (UC as *Bryum pseudotriquetrum* (Hedw.) Gaertn, Meyer & Scherb.). *Rae* 159, 929 (CAS).

Pulviger a lyellii (Hook. & Taylor) Plášek, Sawicki & Ochyra (Orthotrichaceae).

(alternate name for *Orthotrichum lyellii* Hook. & Taylor). (*Rae* 81, others 7).

Abundant, 44 locations. On wood, rarely on soil or rock throughout Napa County. *Rae* 132, 1182, 1331, 2603, 3323 (CAS).

Pulviger a papillosa (Hampe) F.Lara, Draper & Garilleti (Orthotrichaceae). (*Rae* 5, others 1).

(previously *Orthotrichum papillosum* Hampe, *Orthotrichum lyellii* Hook. & Taylor in Flora of North America Editorial Committee (2014)). Recognized as *O. papillosum* in 1860, but then reduced to varietal status as *O. lyellii* var. *papillosum* (Hampe) Sull., in 1864. Both names synonymized with *Orthotrichum lyelli* in Flora of North America Editorial Committee (2014). However, *Orthotrichum lyellii* has recently been placed in the separate genus *Pulviger a* by Plášek et al. (2015) but did not consider the status of *Orthotrichum papillosum*. More recently, Lara et al. (2020) considered two entities worthy of species recognition and transferred into the same genus, hence recognizing the new combination *Pulviger a papillosa* for the former *O. papillosum*. I follow the opinion of many Californian bryologists recognizing

P. papillosa as a separate species in this newly established genus.

Uncommon, four locations. On rock and wood, hillsides, Napa Valley and Pope Valley. *Rae* 164, 2930, 3114B, 3332 (CAS).

Rhynchostegium aquaticum A.Jaeger (Brachytheciaceae). (*Rae* 4), others 0.

[*Platyhypnidium aquaticum* (A.Jaeger) M. Fleisch. Rare, two locations. On rock, rarely on wood, along Moore Creek and Dry Creek, end of Patrick Road. *Rae* 535, 574 (CAS).

Rosulabryum canariense (Brid.) Ochyra (Bryaceae). (*Rae* 1, others 1).

Rare, two locations. On wood at American Canyon Eucalyptus Grove (site recently demolished), Napa Valley. *Koch* 1401 (UC as *Bryum hendersonii* Renauld & Cardot), *Rae* 1893 (CAS).

Rosulabryum capillare (Hedw.) J.R.Spence (Bryaceae). (*Rae* 2, others 3).

Uncommon, four locations. On rock, on slopes around Napa Valley, Howell Mountain Plateau. *Koch* 1361 (UC), *Hutchison* 902 (UC), *Norris* 48246 (UC), *Rae* 636 (CAS), *Shevock* 29848 (CAS).

Rosulabryum gemmascens (Kindb.) J.R.Spence (Bryaceae). (*Rae* 15, others 0).

Common, eight locations. On soil, rock and wood throughout Napa County. *Rae* 803, 2846, 2936, 2941, 3481 (CAS).

Rosulabryum torquescens (Bruch & Schimp.) J.R.Spence (Bryaceae). (*Rae* 3, others 0).

Rare, two locations. On soil along Diamond Mountain Road, Pope Valley. *Rae* 2666, 3310 (CAS). Historical reference: Syed (1973).

Schistidium cinclidodonteum (Müll.Hal.) B.Bremer (Grimmiaceae). (*Rae* 5, others 0).

Uncommon, three locations. On rock, mostly aquatic, along watercourses around upper Napa Valley, Howell Mountain Plateau, Conn Valley Road. *Rae* 1287, 3087, 3129 (CAS).

Schistidium rivulare (Brid.) Podp. (Grimmiaceae). (*Rae* 1, others 0).

Rare, one location. On rock, aquatic, Howell Mountain Plateau. *Rae* 2610 (CAS).

Schistidium splendens T.T.McIntosh, H.H.Blom, D.R.Toren & Shevock (Grimmiaceae). (*Rae* 2, others 0).

Rare, two locations. On rock at Soda Springs Resort and Mt. St. Helena. *Mann s.n.* (NY), *Mann s.n.* (NY) (as *Grimmia apocarpa* var. *gracilis* (Schleich.) F.Weber & D.Mohr, determined by David Toren), *Rae* 3118 (CAS).

Schistidium squarrosus T.T.McIntosh, H.H.Blom, D.R.Toren & Shevock (Grimmiaceae). (*Rae* 1, others 1).

Rare, two locations. On rock, Mt. St. Helena, Oat Hill Mine Road. *Rae* 886 (CAS); *Shevock* 44635

(CAS, MO, NY). Historical reference: McIntosh et al. (2015).

Sciuro-hypnum plumosum (Hedw.) Ignatov & Huttunen (Brachytheciaceae). (Rae 1, others 0).

Rare, one location. Previously recognized as *Brachythecium plumosum* (Hedw.) Schimp. (Ignatov and Huttunen 2002). On soil along Wild Horse Valley Road. *Rae 174A* (CAS).

Scleropodium californicum (Lesq.) Kindb. (Brachytheciaceae). (Rae 1, others 0).

Rare, one location. On soil, Wild Horse Valley. *Rae 215* (CAS).

Scleropodium cespitans (Müll.Hal.) L.F.Koch (Brachytheciaceae). (Rae 29, others 0).

Common, eighteen locations. On soil, rock and wood, some aquatic, City of Napa, Mayacamas Mountains, Howell Mountain Plateau, Oat Hill Mine Road. *Rae 2861A, 3378, 3400, 3429, 3549* (CAS).

Scleropodium julaceum E.Lawton (Brachytheciaceae). (Rae 1, others 1).

Rare, two locations. On concrete bridge abutment in City of Napa, Mt. St. Helena. *Rae 3542* (CAS); *Shevock, Burge & Penneys 44627* (CAS).

Scleropodium obtusifolium (Mitt.) Kindb. (Brachytheciaceae). (Rae 62, others 3).

Abundant, 27 locations; On soil, rock and wood, some aquatic, widespread throughout Napa County. *Koch 1364* (UC), *Rae 3326, 3335, 3336* (CAS), *Shevock 29845* (CAS), *Shevock, Burge & Penneys 44632* (CAS).

Scleropodium occidentale B.E.Carter (Brachytheciaceae). (Rae 11, others 0).

Common, seven locations. On soil, rock and wood, some aquatic, within riparian corridors on hillsides around Napa County, Mt. St. Helena. *Rae 362, 925A, 2640, 2549A, 3443* (CAS).

Scleropodium touretii (Brid.) L.F.Koch (Brachytheciaceae). (Rae 66, others 5).

Abundant, 31 locations. On soil, rock, and wood, some aquatic throughout Napa County. *Koch 1345, 1375* (UC); *Lyman s.n.* (UC as *Scleropodium illicium* Schimp.), *Rae 615, 286, 3463* (CAS).

Syntrichia laevipila Brid. (Pottiaceae). (Rae 1, others 0).

Rare, one location. On rock, Olive Orchard Day Use Area at Lake Berryessa. *Rae 3501* (CAS).

Syntrichia latifolia (Bruch ex Hartm.) Huebener (Pottiaceae). (Rae 2, others 1).

Uncommon, three locations. On rock, City of Napa, Lake Berryessa, Mt. St. Helena. *Rae 3500, 3533* (CAS), *Shevock, Burge & Penneys 44624* (CAS).

Syntrichia montana Nees (Pottiaceae). (Rae 4, others 1).

Uncommon, four locations. On rock, Mt. St. Helena, Howell Mountain Plateau. *Rae 882A, 2601, 2868, 3349A* (CAS); *Shevock, Burge & Penneys 44624* (CAS).

Syntrichia princeps (DeNot.) Mitt. (Pottiaceae). (Rae 47, others 3).

Abundant, 25 locations. On rock and wood, rarely on soil, mostly within wooded areas throughout Napa County. *Lyman s.n.* (UC as *Tortula princeps* DeNot.), *O'Brien 3038* (UC), *Rae 2615, 3349, 3365, 3383* (CAS), *Wagner & Ranzoni 2337* (UC).

Syntrichia ruralis (Hedw.) F.Weber & D.Mohr (Pottiaceae). (Rae 0, others 1).

Rare, one location. (No habitat or site data). Koch 2116 (ILL as *Tortula ruralis* var. *giganteum* (Hedw.) Crome, specimen not examined).

Timmiella anomala (Bruch & Schimp.) Limpr. (Pottiaceae) (Rae 7, others 0).

Common, six locations. On soil within wooded areas, on hillsides around Napa Valley. *Rae 621, 1361, 1456, 1593, 1616* (CAS).

Timmiella crassinervis (Hampe) L.F.Koch (Pottiaceae). (Rae 20, others 1).

Common, 16 locations. On soil, rarely on rock, rarely aquatic on rock, within wooded areas throughout Napa County. *O'Brien 3040* (UC), *Rae 338, 568, 2618, 2952, 3139* (CAS).

Tortella tortuosa (Schrad. ex Hedw.) Limpr. (Pottiaceae). (Rae 1, others 0).

Rare, one location. On soil, Mayacamas Mountains. *Rae 1776* (CAS).

Tortula atrovirens (Sm.) Lindb. (Pottiaceae). (Rae 4, others 0).

Uncommon, three locations. On soil and rock, along hillsides east side of Napa Valley, Knoxville. *Rae 925B, 1326, 3403* (CAS).

Tortula bolanderi (Lesq.) M.Howe (Pottiaceae). (Rae 0, others 1).

Rare, one location. On rock in grassland along Putah Creek canyon just west of Lake Berryessa. *Norris 48256* (UC).

Tortula brevipes (Lesq.) Broth. (Pottiaceae). (Rae 0, others 1).

Rare, one location. No habitat or side data. Location data from 1885 collection not listed in Consortium of North America Bryophyte Herbaria (2020). *Greene s.n.* (NY specimen not examined).

Tortula guepinii (Bruch & Schimp.) Broth. (Pottiaceae). (Rae 1, others 0).

Rare, one location. On rock, along Oat Hill Mine Road. *Rae 885* (CAS).

Tortula inermis (Brid.) Mont. (Pottiaceae). (Rae 1, others 0).

Rare, one location. On rock, Mayacamas Mountains. *Rae 1145* (CAS).

Tortula muralis Hedw. (Pottiaceae). (Rae 4, others 0). Uncommon, three locations. On concrete and brick, City of Napa. *Rae* 249, 389, 872 (CAS).

Tortula subulata Hedw. (Pottiaceae). (Rae 4, others 0). Uncommon, three locations. On soil and rock, Mt. St. Helena and northeastern edge of Howell Mountain Plateau. *Rae* 1203, 2607, 3111 (CAS).

Triquetrella californica (Lesq.) Grout (Pottiaceae). (Rae 1, others 0). Rare, one location. On soil, Soscol Ridge. *Rae* 1089 (CAS) (only five shoots collected).

Ulota megalospora Vent. (Orthotrichaceae). (Rae 1, others 0). Rare, one location. On wood, near east end of Stonecrest Drive, City of Napa. *Rae* 1071 (CAS).

Weissia controversa Hedw. (Pottiaceae). (Rae 7, others 0). Uncommon, five locations. On soil and rock, Soscol Ridge and lower slopes along east side of Napa Valley. *Rae* 667, 1085, 1097, 1265, 3479 (CAS).

Weissia ligulifolia (E. B. Bartram) Grout (Pottiaceae). (Rae 1, others 0). Rare, one location. On wood, along Howell Mountain Road near Silverado Trail. *Rae* 635 (CAS).

DOUBTFUL OR UNCONFIRMED MOSSES EXCLUDED FROM PRELIMINARY CATALOGUE.

Aloina rigida (Hedw.) Limpr. (Pottiaceae). Distribution in Napa County is reported by Koch (1950), but without collection number. The Consortium of North American Bryophyte Herbaria (2020) does not include an *Aloina rigida* (Hedw.) Limpr., collection in Napa County by L.F. Koch. Historical reference: Koch (1950). Presence not confirmed for California (Flora of North America Editorial Committee 2007) hence I excluded it from the main list.

Fissidens pauperculus Howe (Fissidentaceae). Reported as collected within Wildcat Canyon, Howell Mountain Plateau, but without collection number. The Consortium of North American Bryophyte Herbaria (2020) does not include a *Fissidens pauperculus* collection in Napa County by L.F. Koch. Historical reference: Koch (1951). Presence not confirmed, hence I excluded it from the main list.

Fontinalis neomexicana Sull. & Lesq. (Fontinalaceae). Collected by Koch (*Koch* 1363) and deposited at ILL, the packet label included Napa County, but lacks habitat and site data (Consortium of North American Bryophyte Herbaria 2020) According to L. Minnaert-Grote (ILL, personal communication) this specimen was not located and may reside in storage of yet-to-be accessioned collections. Welch (1960) reported the Koch collection but did not provide additional habitat or site data. Reported in California by Norris and Shevock (2004a), but a Napa

County location not cited. Since this collection could not be located, and in the absence of specific collection location information, the species has been excluded from the catalogue.

Grimmia anodon Bruch & Schimp. (Grimmiaceae). Distribution in Napa County is reported by Koch (1950), but without collection number. The Consortium of North American Bryophyte Herbaria (2020) does not include a *Grimmia anodon* collection in Napa County by L. F. Koch. Historical reference: Koch (1950), Ireland and Miller (1982), Norris and Shevock (2004a). Collection not located. Presence not confirmed, hence I excluded it from the main list.

Grimmia caespiticia (Brid.) Jur. (Grimmiaceae). The original report is confused with *Grimmia sessitana* DeNot. (Flora North America Editorial Committee 2007) (D. Toren, CAS, personal communication 2020). Historical references based on original confused report: Muñoz (1998); Norris and Shevock (2004a).

Grimmia manniae Holz. (Grimmiaceae). The two Marilyn Mann *s.n.* 1886 collections at NY are largely *Schistidium splendens* T.T.McIntosh, H.H.Blom, D.R.Toren & Shevock, with a small mixture of other taxa (D. Toren, personal communication). Both packets were collected at Napa Soda Springs, a long abandoned Napa County resort closed to the public. Originally identified by Holzinger in 1887 (Müller 1887) as *Grimmia manniae* Holz., the species was later confused with *Grimmia ovalis* (Hedw.) Lindb. and *Grimmia tergestina* Tømm. ex Bruch & Schimp. (Holzinger 1901, Lawton 1971, Hastings 2008). Although subsequently annotated as fragmentary and sterile *Grimmia torenii* Hastings (Hastings 2008), recent examination by D. Toren (CAS, personal communication) determined the material is most likely *Grimmia alpestris* (Schleich.) F.Weber & D.Mohr Based on the clarification by Toren, I have excluded the name *Grimmia manniae* from the main list. The collection is cited in the main list as *Schistidium splendens*. And, resulting from the examination of the mixture in the packets by Toren, I have added *Grimmia alpestris* to the main list. TROPICOS (2020) synonymizes *G. manniae* with *G. caespiticia* (Brid.) Jur.

Grimmia torenii Hastings. (Grimmiaceae). See note for *Grimmia manniae* Holz., above.

Schistidium apocarpum var. **gracile** (Röhl.) Bruch & Schimp. (Grimmiaceae). D. Toren has determined this collection to be *Schistidium splendens* T.T.McIntosh, H.H.Blom, D.R.Toren & Shevock. Therefore, I have excluded the name *Schistidium apocarpum* var. *gracile* from the main list, replacing it with *Schistidium splendens*.

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BRYOFLORA OF THE RUSSIAN WILDERNESS AND ADJACENT SLOPES OF THE SALMON MOUNTAINS, KLAMATH NATIONAL FOREST, SISKIYOU COUNTY, CALIFORNIA

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ABSTRACT

The bryoflora of the Russian Wilderness and adjacent slopes, an area of 112.8 mi² (292 km²), comprises only 1.8% of the land base of Siskiyou County at 6347 mi² (16,439 km²), the fifth largest county in California. Fifty liverworts and 215 mosses (includes four undescribed taxa) are documented by voucher specimens. This represents 33% for both the liverworts and the mosses documented for California. Three species, *Lophozia longidens* (Lindb.) Macoun, *Lophozia obtusa* (Lindb.) A.Evans, and *Solenostoma schusterianum* (J.D.Godfrey & G.Godfrey) Vána, Hentschel & Heinrichs are reported as new for California. *Grimmia brevirostris* R.S.Williams is elevated from synonymy with *Grimmia hamulosa* Lesq., as a species worthy of recognition and represents the first records of this California endemic for the Klamath Ranges.

Key Words: bryogeography, bryophyte inventories, California Floristic Province, Klamath Ranges, liverworts, mosses, Northern California.

The Russian Wilderness, an area of 12,700 acres (5140 hectares), covers a portion of the crest of the Salmon Mountains within the Klamath National Forest, Siskiyou County, California (Fig. 1). The area is accessed by roads about an hour's drive west of Interstate 5 from either the towns of Weed or Yreka. The Russian Wilderness was one of several areas established by Congress by the passage of the California Wilderness Act of 1984 and signed into federal law by President Reagan. Situated between the northernmost portion of the Trinity Alps Wilderness to the immediate south and the Marble Mountain Wilderness directly to the north, the Russian Wilderness contains nearly 100 mi of hiking trails. The Pacific Crest Trail bisects the Russian Wilderness along the crest of the Salmon Mountains for approximately 18.5 mi.

Besides the Russian Wilderness boundary, this bryoflora also covers the adjacent lower slopes of a portion of the Salmon Mountains within the Klamath National Forest for an additional 59,497 acres (24,077 hectares) (Fig. 1) for a total of 112.8 mi² (292.2 km²). All of the forest roads that provide access to trailheads into the Russian Wilderness were incorporated into this study. There are 11 established trailheads that offer access into the wilderness, although some trails are less frequently used. This boundary seemed like the best approach for such a floristic undertaking since it incorporates the immediate creek drainages that originate within the Russian Wilderness. The creeks to the east of the Salmon Mountains crest are within the Scott River Basin and the creeks on the western side of the crest are in the Salmon River Basin. Both the Salmon and

Scott Rivers eventually merge with the Klamath River.

Two paved county roads running east–west form the northern and southern boundaries of the study area. The northern boundary of the study is county road (1C01) between Etna and Sawyers Bar with the highest point at Etna Summit 5912 ft (1597 m) from where the Pacific Crest Trail heads north into the Marble Mountain Wilderness and south into the Russian Wilderness. The southern boundary is formed by county road (1C02) between Callahan and Cecilville with the highest point at Carter Meadows Summit at 6207 ft (1892 m) where the Pacific Crest Trail heads north into the Russian Wilderness and south into the Trinity Alps Wilderness. The eastern boundary is the Klamath National Forest boundary that is upslope of California Highway 3 between Etna and Callahan. However, private forest land dominates much of this area, so forest road 41N14 served as the eastern road access. The western boundary is formed by forest roads 40N61 and 39N20. The western section of the project area is split between the watersheds of the North Fork and the East Fork of the South Fork Salmon River. The lowest elevation in the study area occurs at 2425 ft (739 m) along the North Fork Salmon River at the junction with forest road 40N61. The highest point is the summit of Russian Peak at 8196 ft (2496 m).

The area that eventually became the Russian Wilderness was the final Congressional resolution regarding a multi-year Forest Service roadless inventory process directed to evaluate various public lands with potential wilderness characteristics. Boundaries of roadless areas basically excluded

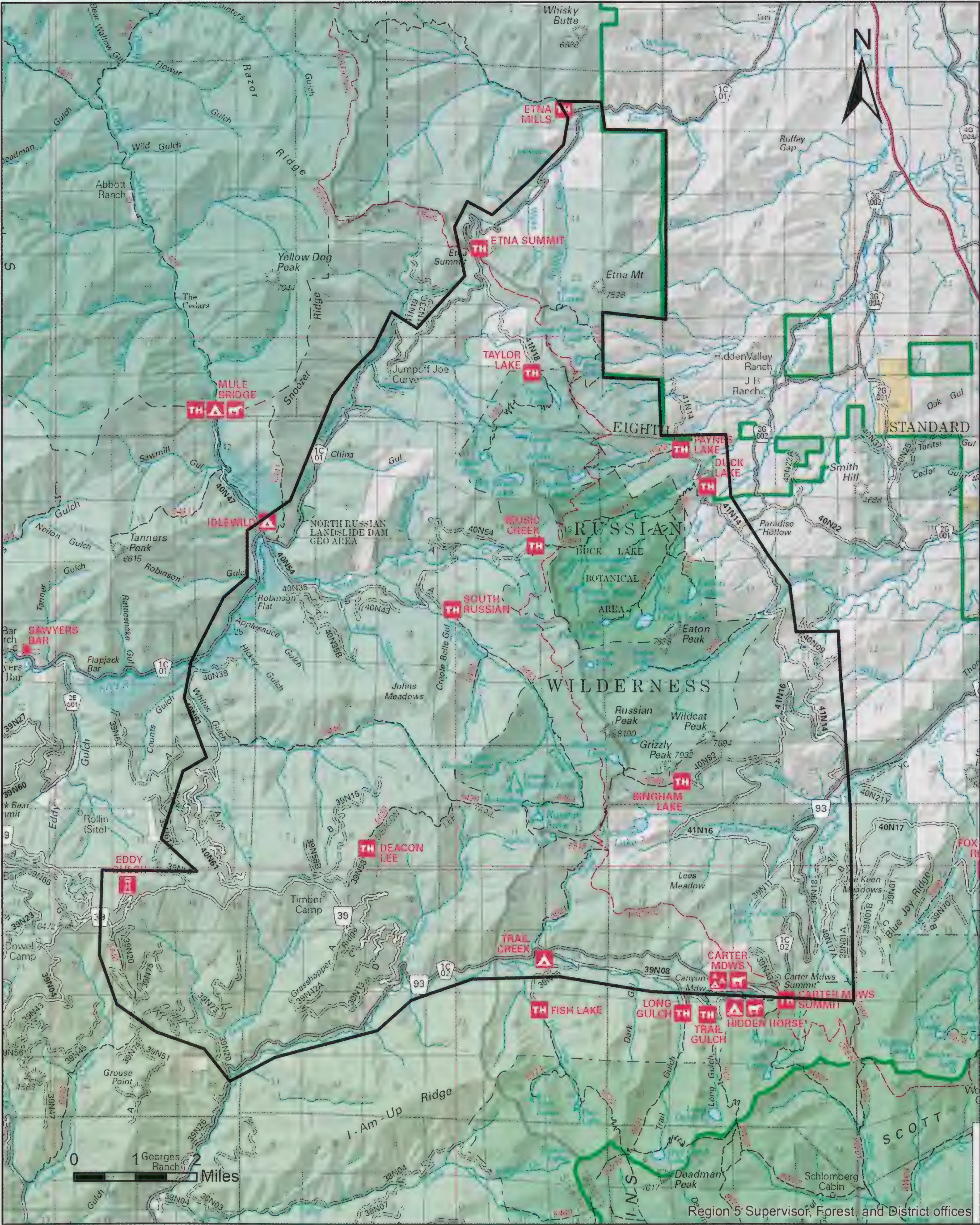


FIG. 1. Russian Wilderness and surrounding Salmon Mountains.

landscapes with roads, as well as any adjacent areas in private ownership. The crest of the Salmon Mountains is so rugged that road building for various multiple land uses was deemed either uneconomical or not feasible. Therefore, this wilder-

ness boundary is confined to the highest elevations of rugged mountainous terrain within the Klamath National Forest, Siskiyou County, whereas the middle and lower elevations of the Salmon Mountains that were either previously roaded or were



FIG. 2. Big Duck Lake within the Duck Lake Botanical Area, surrounded by granitic rocks, Russian Wilderness, photo by Dave Wildman, July 2020.

highly desired to become roaded for other multiple uses, such as timber harvesting, were excluded during the political process to establish the Russian Wilderness boundary. Large areas of unroaded landscape were excluded from the authorizing legislation that created the Russian Wilderness. Therefore, the wilderness boundary has few physiographic features and is difficult to determine especially as it crosses the landscape mid-slope.

Geologically, the Russian Wilderness is primarily granitic rock with expansive areas of granodiorite plutons. The geology is metamorphic along the lower slopes of the Salmon Mountains below the wilderness boundary, although a large area of metamorphics occurs along the Pacific Crest Trail at Etna Summit and northward from Carter Meadows Summit toward the wilderness boundary. The ridge immediately eastward from the Deacon Lee Trailhead along the crest separating the South and North Forks of the Salmon River is also metamorphic rock. The rugged crest of the Salmon Mountains within the Russian Wilderness is granite rocks. There is a very limited area of serpentine rock and a small area of marble occurs along the western edge of the project boundary at Whites Gulch (forest road 40N61). Several mining claims are within the North Fork Salmon River, especially within the Russian Creek watershed.

There are 22 named lakes within the Russian Wilderness, but not all of these are accessible by maintained trails. Some cross-country treks are required to access these more remote areas of the wilderness. Lying completely within the Russian Wilderness is the Duck Lake Botanical Area (Fig. 2), a land-use designation of 3600 acres (1457 hectares) that was established in 1995 and incorporated in the Klamath National Forest Land Use Plan. This area contains the highest species diversity of conifers in the world occurring within one square mile. Here 18 conifer species inhabit the so-called 'miracle mile' (Sawyer and Thornbough 1967; DeSiervo 2016). It was this extraordinary conifer diversity that spearheaded the conservation movement to create a Russian Wilderness under the Wilderness Act of 1964. The Salmon Mountains also contain a great diversity of vascular plants with at least 500 species reported for the Russian Wilderness, including many Klamath Range endemics. See also Smith (2004, 2019) for vascular species checklists within the Russian Wilderness.

VEGETATION OVERVIEW

This bryoflora is highly influenced by parent rock type, plant communities, and elevational gradient. The entire study area is comprised of various coniferous forests. There are no grasslands, oak

woodlands, or climax chaparral areas. The lower elevations are dominated by forests comprised of *Pseudotsuga menziesii* (Mirbel) Franco mixed with *Calocedrus decurrens* (Torr.) Florin, *Abies concolor* (Gordon & Glend.) Lindl. ex Hildebr., and various *Pinus* spp., especially *Pinus jeffreyi* Grev. & Balf., *P. ponderosa* Laws., and *P. lambertiana* Douglas. Many of these lower elevation forests have hardwood components with *Quercus kelloggii* Newb., *Acer macrophyllum* Pursh, *Arbutus menziesii* Pursh, and on drier sites with *Quercus chrysolepis* Liebm. Along riparian corridors, *Alnus rhombifolia* Nutt., can be common and *Cornus sericea* L., *Corylus cornuta* Marsh var. *californica* (DC.) W.Sharp, and *Philadelphus lewisii* Pursh are frequent associates. *Taxus brevifolia* Nutt., is most often encountered along shaded riparian areas in mid-elevations of the study area. The spectacular 1 m tall rheophyte, *Darmera peltata* (Torr. ex Benth.) Voss, can carpet the banks of stream channels generally below 4000 ft (1219 m) in the study area. Fortunately, *Toxicodendron diversilobum* (Torr. & A.Gray) E.Greene is restricted to the lowest elevations within the study area. Slopes above 5000 ft (1524 m) become increasingly dominated by *Abies magnifica* A.Murray. The subalpine region is dominated by *Tsuga mertensiana* (Bong.) Carrière and *Abies magnifica* and the var. *shastensis* Lemmon, although several other conifer species can be observed on more exposed rocky slopes. Riparian areas with greater snowpack are lined with *Alnus incana* (L.) Moench ssp. *tenuifolia* (Nutt.) Breitung as the dominant shrub, although *Alnus viridis* (Chaix) DC. ssp. *sinuata* (Regel) A.Löve & D.Löve can also be common. Areas that have experienced high intensity wildfire are currently covered by *Arctostaphylos patula* E. Greene, *Ceanothus velutinus* Hook., *Chrysolepis sempervirens* (Kellogg) Hjelmq., and *Quercus vaccinifolia* Kellogg until such time that conifers reestablish the area.

Fens within the study area are uncommon, small, and generally located adjacent to lakes. Areas around lakes in the higher elevations are dominated by *Ledum glandulosum* Nutt., *Leucothoe davisiae* Torrey, *Phyllodoce breweri* (A.Gray) Maxim, and occasionally with *Vaccinium uliginosum* L. ssp. *occidentale* (A.Gray) Hultén. *Spiraea douglasii* Hook., is also a common associate. *Darlingtonia californica* Torr., a common and showy species restricted to fen and streambank habitats with ultramafic geology is widely distributed in the Klamath Ranges, but absent in the study area.

The greatest species diversity of bryophytes in the study area is located within riparian corridors with increasing humidity, especially along the larger streams in lower elevations of the study area. Intermittent streamlets and rivulets are the areas with greatest bryophyte cover and diversity in the subalpine zone. Many of the bryophytes in the project area are rheophytes or semi-rheophytes, and some of the liverworts are perennially submerged. Few bryophytes occur on trunks of conifers, especially with

increasing elevation. *Orthodicranum tauricum* (Sapje-gin) Smirnova followed by *Aulacomnium androgynum* (Hedw.) Schwägr., are the most frequently encountered moss species on conifer trunks in the project area. Tree trunks in the subalpine area of the project basically lack bryophyte colonization, probably due to both the duration of the annual winter snowpack and increased direct sunlight and exposure during the summer. In the lower elevations with a hardwood component, bryophyte cover can be substantial, especially on *Acer macrophyllum*, *Quercus kelloggii*, and *Alnus rhombifolia*.

METHODS

Field work by the first author was primarily conducted during the summer and fall of 2020, although two earlier collecting events occurred in 2012 and in 2019. Nearly every trail in the wilderness was accessed and all roads to trailheads were surveyed. On occasion other colleagues joined day hikes into the wilderness as co-collectors. A total of 1125 collections were made by the first author during the field component of this study. Colleague Ken Kellman made 57 collections during a 2012 trip to Sugar Lake and Jason Brooks added 38 collections during joint trips in 2020. All of the collections made by the first author during this study received detailed locality information, GPS coordinates, elevation, date, basic description of the overall vegetation type, and detailed microhabitat information, as is necessary for a high-quality herbarium label. All specimens obtained by the first author are accessioned at the California Academy of Sciences (CAS) with duplicates provided where applicable to additional herbaria. Various monographs, the bryophyte volumes of the *Flora of North America North of Mexico* (Flora of North America Editorial Committee 2007, 2014 and vol. 29 in prep.), Norris and Shevock (2004a, b), Doyle and Stotler (2006), Whittemore (2020), and Wagner (2021a) were the primary references used for the identification of specimens and compared among specimens in herbaria.

COLLECTION HISTORY

The study area portion of the Salmon Mountains has generally received less plant collecting compared to areas that are now part of the Trinity Alps Wilderness to the south or the Marble Mountain Wilderness area to the north. A search of specimen records (Consortium of North American Herbaria 2020) for collections obtained from Siskiyou County within the herbaria of CAS, MO, NY, UC was conducted to locate efforts by earlier botanists who collected bryophytes in what is now the Russian Wilderness and adjacent slopes. Based on our herbarium search, Daniel H. Norris made the first bryophyte collections from the study area in 1972 during a collecting trip to Big Duck Lake. Norris made eight additional collecting events within the

project boundary with his last trip occurring in 2003. In total, he made 858 collections within this bryoflora boundary. In addition, a master's thesis of the Russian Peak Area (McGrew 1976) was produced under the direction of Norris at Humboldt State University. Karen McGrew focused her efforts on areas surrounding five lakes along the crest of the Salmon Mountains near Russian Peak that is now within the southernmost area of the Russian Wilderness. She reported 111 mosses and 39 liverworts. Of these, 35 mosses and 12 liverworts were based from a single collection. According to McGrew (1976), 786 specimens were collected within her project area including 123 specimens collected by Norris who accompanied her during collecting events in 1974 to Bingham Lake and South Sugar Lake. However, many of the names used for specific collections have subsequently been placed in synonymy, thereby reducing the number of taxa. Other collections represent species not currently viewed as occurring in California (Norris and Shevock 2004a; Doyle and Stotler 2006).

We assumed the McGrew collections were in the Norris herbarium and after his retirement from Humboldt State were eventually transferred to the University of California, Berkeley (UC). Although as of late 2020, the McGrew collections do not appear on a bryophyteportal search within the UC holdings. However, the UC collection manager, during an initial search, located several McGrew specimens. We have concluded that all of the liverwort collections cited in McGrew (1976) are not at UC, but are instead at the Helsinki Museum (H). These were brought to H during the period when Norris was a resident in Helsinki. When Norris returned to the United States, only his moss herbarium returned with him, except Californian *Marsupella*, which had been on loan to the third author and have now been deposited at UC. The liverworts remained at H for the purpose of developing a liverwort flora of California, although that project never materialized.

Unfortunately, access to the UC herbarium was also greatly limited during the COVID-19 pandemic, and, therefore, many of the earlier McGrew and Norris moss collections from the study area were not retrieved to confirm the identifications. However, we did prioritize our herbarium efforts to locate those collections reported by McGrew (1976) for taxa not obtained by the first author from the study area. This smaller subset of collections was located by the UC collections manager and provided to us on loan so they could be studied. Several of these collections were determined to be misidentified (Appendix 1). Therefore, only the McGrew and Norris collections that were located, confirmed, or annotated appear within this catalogue. More recently, Martin Lenz collected 26 mosses and six liverworts in the project area during 2006 and his personal bryophyte herbarium is now incorporated into CAS. The Lenz moss collections cited herein were examined and annotated by the second author and the liverworts by the third author.

RESULTS AND DISCUSSION

Based on a review of both earlier collections and those obtained during the formulation of this study, the bryoflora of the Russian Wilderness and adjacent slopes contain 50 liverworts in 28 genera and 23 families and 215 mosses in 99 genera and 41 families (Table 1). No hornworts were documented. The largest liverwort families are the Lophoziaceae (8) and Scapaniaceae (6). Most of the liverwort families in the project area are represented by a single taxon. The five largest moss families for California within the study area are the Grimmiaceae (30), Bryaceae (24), Brachytheciaceae (20), Mniaceae (15), and Pottiaceae (14). These are the same five largest moss families as reported for California in Norris and Shevock (2004a), except the Pottiaceae shifts from first place to fifth. Several bryophyte species with wide geographic or habitat parameters located within coniferous forest environments throughout Northern California were not documented for the study area. We view these taxa simply as not present or as occurring in such small quantity that they were not encountered during the field inventory process. Nonetheless, we view this bryoflora to be greater than 90% complete due to the number of specimens obtained and diversity of habitats surveyed. Fens within the Russian Wilderness are also less species rich in bryophytes than elsewhere in northern California, but part of this may simply be the small and isolated areas of fen habitats available for bryophyte colonization generally located about lake margins. Although many meadows on hillsides are wet during snowmelt, they quickly become dry by late summer and bryophyte colonization or utilization of such habitats is uncommon.

One moss species, *Tripterocladium leucocladulum* (Müll.Hal.) A.Jaeger, an exceedingly rare species in California, was documented along both the North Russian and Russian Creek, the latter site near the confluence with the North Fork Salmon River. It seems to prefer areas of higher humidity along creeks and streams. This is currently the southernmost outpost for this species in the state. Another moss, *Grimmia brevirostris* R.S.Williams, a California endemic, known previously from the Plumas National Forest (Dillingham 2015) is new for the Klamath Ranges. Most populations of *G. brevirostris* were discovered within the Russian Wilderness. We also report the first California record for the liverwort *Lophozia longidens* (Lindb.) Macoun, *Lophozia obtusa* (Lindb.) A.Evans, and *Solenostoma schusterianum* (J.D.Godfrey & G.Godfrey) Vána, Hentschel & Heinrichs.

Not all bryophyte collections examined could be named to species with a high degree of confidence, especially when closely related species pairs are separated by capsule morphology, sexuality, or spore size. This is often the case among some members of *Ptychostomum* Hornsch., where sporophytic plants are much less commonly encountered. Some liver-

TABLE 1. Synopsis of liverwort and moss genera and number of taxa by family placement.

Group	Family	Genus (number of taxa)
Liverworts	Aneuraceae	<i>Aneura</i> (1) <i>Riccardia</i> (1)
	Aytoniaceae	<i>Mannia</i> (1)
	Blepharostomataceae	<i>Blepharostoma</i> (1)
	Calypogeiaceae	<i>Calypogeia</i> (3)
	Cephaloziaceae	<i>Cephalozia</i> (4)
	Cephaloziellaceae	<i>Cephaloziella</i> (1)
	Cleveaceae	<i>Clevea</i> (1)
	Conocephalaceae	<i>Conocephalum</i> (1)
	Fossombroniaceae	<i>Fossombronia</i> (1)
	Frullaniaceae	<i>Frullania</i> (1)
	Gymnomitriaceae	<i>Marsupella</i> (1)
	Jungermanniaceae	<i>Jungermannia</i> (2) <i>Liochlaena</i> (1)
	Lophocoleaceae	<i>Chiloscyphus</i> (2)
		<i>Lophocolea</i> (2)
	Lophoziaceae	<i>Barbilophozia</i> (1)
		<i>Lophozia</i> (7)
	Marchantiaceae	<i>Marchantia</i> (1)
	Pelliaceae	<i>Pellia</i> (2)
	Plagiochilaceae	<i>Plagiochila</i> (1)
	Porellaceae	<i>Porella</i> (2)
	Ptilidiaceae	<i>Ptilidium</i> (1)
	Radulaceae	<i>Radula</i> (1)
	Ricciaceae	<i>Riccia</i> (3)
	Scapaniaceae	<i>Diplophyllum</i> (1)
		<i>Scapania</i> (5)
Mosses	Solenostomataceae	<i>Solenostoma</i> (1)
	Amblystegiaceae	<i>Amblystegium</i> (1)
		<i>Campylium</i> (1)
		<i>Conardia</i> (1)
		<i>Cratoneuron</i> (1)
		<i>Drepanocladus</i> (1)
		<i>Hygrohypnella</i> (1)
		<i>Platyhypnum</i> (4)
		<i>Sanionia</i> (1)
		<i>Sarmentypnum</i> (1)
		<i>Andreaea</i> (3)
		<i>Aulacomnium</i> (2)
	Bartramiaceae	<i>Anacolia</i> (1)
		<i>Bartramia</i> (2)
		<i>Philonotis</i> (5)
	Brachytheciaceae	<i>Brachytheciastrum</i> (3)
		<i>Brachythecium</i> (5)
		<i>Eurhynchiastrum</i> (1)
		<i>Homalothecium</i> (5)
		<i>Kindbergia</i> (2)
		<i>Scleropodium</i> (3)
		<i>Trachybryum</i> (1)
	Bryaceae	<i>Bryum</i> (3)
		<i>Gemmabryum</i> (4)
		<i>Imbribryum</i> (4)
		<i>Ptychostomum</i> (6)
		<i>Roellobryon</i> (1)
		<i>Rosulabryum</i> (6)
		<i>Buxbaumia</i> (1)
		<i>Straminergon</i> (1)
	Cryphaeaceae	<i>Dendroalsia</i> (1)
	Dicranaceae	<i>Dicranella</i> (1)
		<i>Dicranum</i> (3)
		<i>Orthodicranum</i> (1)
	Ditrichaceae	<i>Ceratodon</i> (2)
		<i>Ditrichum</i> (1)

TABLE 1. CONTINUED

Group	Family	Genus (number of taxa)
	Encalyptaceae	<i>Encalypta</i> (2)
	Fabroniaceae	<i>Fabronia</i> (1)
	Fissidentaceae	<i>Fissidens</i> (5)
	Fontinalaceae	<i>Fontinalis</i> (4)
	Funariaceae	<i>Funaria</i> (1)
	Grimmiaceae	<i>Bucklandiella</i> (6)
		<i>Codriophorus</i> (3)
		<i>Dryptodon</i> (1)
		<i>Frisvollia</i> (1)
		<i>Grimmia</i> (13)
		<i>Schistidium</i> (6)
		<i>Hedwigia</i> (2)
		<i>Pseudobraunia</i> (1)
		<i>Hookeria</i> (1)
		<i>Hylocomiadelphus</i> (1)
	Lembophyllaceae	<i>Isothecium</i> (2)
		<i>Tripterocladium</i> (1)
	Leskeaceae	<i>Claopodium</i> (2)
	Leucodontaceae	<i>Antitrichia</i> (1)
	Meesiaceae	<i>Leptobryum</i> (1)
	Mniaceae	<i>Leucolepis</i> (1)
		<i>Mnium</i> (1)
		<i>Plagiomnium</i> (4)
		<i>Pohlia</i> (6)
		<i>Rhizomnium</i> (3)
		<i>Dannorisia</i> (1)
		<i>Metaneckera</i> (1)
		<i>Neckera</i> (1)
		<i>Lewinskya</i> (4)
		<i>Orthotrichum</i> (5)
	Plagiotheciaceae	<i>Pulviger</i> (2)
		<i>Herzogiella</i> (1)
		<i>Isopterygiopsis</i> (1)
		<i>Plagiothecium</i> (2)
		<i>Platydictya</i> (1)
		<i>Pseudotaxiphyllum</i> (1)
		<i>Rectithecium</i> (1)
	Polytrichaceae	<i>Atrichum</i> (1)
		<i>Meiotrichum</i> (1)
		<i>Polytrichastrum</i> (1)
		<i>Polytrichum</i> (3)
		<i>Bryoerythrophyllum</i> (1)
	Pottiaceae	<i>Didymodon</i> (5)
		<i>Hymenostylium</i> (1)
		<i>Syntrichia</i> (4)
		<i>Tortula</i> (2)
		<i>Weissia</i> (1)
		<i>Pseudoleskea</i> (5)
		<i>Pterigynandrum</i> (1)
		<i>Ptychomitrium</i> (1)
		<i>Trochophyllohypnum</i> (1)
		<i>Rhabdoweisia</i> (2)
	Scouleriaceae	<i>Cynodontium</i> (1)
		<i>Dichodontium</i> (2)
		<i>Dicranoweisia</i> (1)
		<i>Hymenoloma</i> (1)
		<i>Kiaeria</i> (2)
		<i>Oncophorus</i> (1)
		<i>Scouleria</i> (1)
		<i>Blindia</i> (1)
		<i>Sphagnum</i> (1)
		<i>Stereodon</i> (1)
	Timmiaceae	<i>Timmia</i> (1)
	Timmiellaceae	<i>Timmiella</i> (1)

worts were also problematic to name to species among those genera where oil bodies are critical diagnostic features to separate closely related taxa. We have highlighted these issues in the narratives for particular species in the catalogue.

During the course of developing this bryoflora, we view at least four mosses in the study area as undescribed taxa. One of these, a *Syntrichia* Brid., with a very broad costa at the leaf base is rather widespread in mountainous northern California, while the other three taxa are considerably more restricted. A species of *Imbribryum* N.Pedersen was collected only once in the study area and a species resembling a *Philonotis* Brid., in a fen below Russian Lake and at Taylor Lake is identical to specimens previously collected on the Plumas National Forest. The fourth is a new species of *Grimmia* Hedw. These plants from subalpine areas were determined to be an undescribed species by Jesús Muñoz, an authority on this genus (Muñoz, Real Jardín Botánico, personal communication). These specimens have been provided to specialists in these taxonomic groups for both molecular and morphological study.

CONSERVATION IMPLICATIONS

Clearly, the greatest threat to the bryoflora of the Russian Wilderness and adjacent slopes is the increased probability of widespread stand-replacing wildfires as a result of ongoing climate change. Sawyer and Thornbough (1967) provide an excellent overview of the forests within the Klamath Range. Some aspects and changes of both forest structure and conifer mortality are already becoming evident as outlined in DeSiervo et al. (2016) based on observed changes to forest structure since the Sawyer and Thornburgh vegetation transects were conducted in 1969. One large wildfire has already altered the Russian Wilderness area (Whites Fire of 2014), not only on lower slopes in the North Fork Salmon River Basin, but also along the crest within subalpine forests above Music Creek Trailhead and slopes along the Deacon Lee Trail. The other impact especially to meadow and fen habitats is cattle grazing. While the Russian Wilderness has limited grazing opportunities, it is a historic permitted activity that continues to negatively impact riparian areas.

As has been documented with other localized bryofloras published in California (i.e., Kellman 2003; Dillingham 2015; Toren 2015), many species are rare within a particular geographic area. Therefore, localized extirpations are far more likely to impact bryophytes compared to other plant groups, especially for species far removed from the nearest occurrence. The probability of re-colonization after a stand replacing event will be very low, especially if a specific micro-habitat is no longer extant. Several taxa were collected only once within this floristic boundary.

CATALOGUE OF SPECIES

In this catalogue, taxa are arranged alphabetically starting with the liverworts, then followed by the mosses. Nomenclature generally follows the two bryophyte moss volumes of *Flora of North America North of Mexico* (Flora of North America Editorial Committee 2007, 2014), except where more recent taxonomic alterations have been supported by molecular evidence. Scientific names used that are different than displayed in Norris and Shevock (2004a), Malcolm et al. (2008), or Doyle and Stotler (2006) are added in brackets. For liverworts, we have primarily relied on the nomenclature as proposed in the *Synopsis of the Liverworts of North America North of Mexico* (Stotler and Crandall-Stotler 2017), provisional treatments for *Flora of North America North of Mexico* (Vol. 29 in prep.), and *World Checklist of the Liverworts and Hornworts* (Söderström et al. 2016). The checklist and keys of California liverworts and hornworts was also utilized (Whittemore 2020). In addition, Wagner (2021a) provides supplementary information and color photomicrographs. Nearly all of the liverworts obtained from the study area were either confirmed or named by the third author. However, some specimens referenced in McGrew (1976) were examined earlier by Alan Whittemore and we accept his determinations. Occasionally a taxonomic note is added when a name used previously for species occurring in California was misapplied. Table 1 lists the genera as arranged by the most recent moss family placement on the updated on-line *Classification of the Mosses* (Goffinet and Buck 2020) and for the liverworts as displayed in Söderström et al. (2016). The increased attention to phylogenetic analyses in the past decade has resulted in proposals to alter some species circumscriptions, move taxa to different genera, establish new genera, and transfer genera to other families from classifications that rely primarily on morphological and sporophytic character traits. Synonyms of the traditional names and recent proposals can be found online (Tropicos 2020). Some of these new generic and family placements will be apparent in Table 1.

For the specimens cited section, the abbreviation **LS** designates all of the areas (primarily the adjacent lower slopes) within the study area that occur outside of the official wilderness boundary. The abbreviation **RW** is used for all collections obtained within the Russian Wilderness boundary. A majority of species in this bryoflora have specimens cited from both of these geographical units. Since all of the collections within this study area are in Siskiyou County and the Klamath National Forest, these data are omitted from each entry to reduce space. All Shevock collections reside at CAS. Cited specimens not collected by the first author reference the collector, collection number and the Index Herbariorum code in which they reside.

Taxon entries contain comments regarding features of recognition, comparisons and contrasts with similar appearing species, observations regarding micro-habitat specificity, or other bryological, ecological or nomenclatural information. Although we have added insights to recognize the species presented herein based on our field and laboratory experience, further identification can also be aided by using keys to species in Norris and Shevock (2004b), Doyle and Stotler (2006), and Whittemore (2020). Additionally for the liverworts, color microphotographs, keys, and discussions in Wagner (2021a) are also available to confirm identifications.

LIVERWORTS

Aneura pinguis (L.) Dumort.

Ruffly, irregularly branched ribbons with a poorly defined midrib are key field characters for this small thalloid liverwort. The closest look-alike is species of *Pellia* Raddi, from which it differs in having fewer oil bodies and smaller cells. In other parts of the world, this species is known as a calciphile. In western North America, it is not so restricted.

Specimen cited. **RW**: above Sugar Lake along streamlet, 6 Oct 2012, 5975 ft, *Shevock & Kellman 41165* (det. by Alan Whittemore).

Barbilophozia hatcheri (A.Evans) Loeske

This species and members of the *Lophozia ventricosa* (Dicks.) Dumort., complex are common associates in subalpine cliffs and talus slopes. Its three lobed leaves and clusters of reddish gemmae are distinctive under a hand-lens.

Specimens cited. **RW**: W side of Sugar Lake, 6 Oct 2012, 1810 m, *Kellman & Shevock 6932a* (CAS); Sugar Creek about 0.5 mi above forest road 41N14, 28 Oct 2020, 4840 ft, *Shevock 57879*.

Blepharostoma trichophyllum (L.) Dumort.

Under a hand-lens in the field this looks as much like a pale green tangle of filamentous algae as a liverwort. Difficult to describe, but readily recognized from illustrations. The distinctive feature of the genus is having leaves divided completely to the base into uniseriate lobes.

Specimens cited. **LS**: Mill Creek off county road 1C01, 5 mi SW of Etna, 15 Oct 2020, 3950 ft, *Shevock 57622*; *57629b*; **RW**: above Sugar Lake along streamlet, 6 Oct 2012, 5975 ft, *Kellman & Shevock 6942a*, *6944* (CAS) and *Shevock & Kellman 41171*; below outlet of Upper Albert Lake, 14 Aug 2020, 7000 ft, *Shevock 57258a*.

Calypogeia azurea Stotler & Crotz

Diagnostic oil bodies (blue to cyan, botryoidal) were still present in *Shevock & Magnaghi 56946*. The other specimen lacked oil bodies, but has morphology typical of this species.

Specimens cited. **LS**: S end of Ruffey Lake, 16 Oct 2020, 6600 ft, *Shevock 57679*; **RW**: S side of Little

Duck Lake in cascading stream, 3 Jul 2020, 6600 ft, *Shevock & Magnaghi 56946*.

Calypogeia fissa (L.) Raddi

Although Stotler and Crandall-Stotler (2017) suggest our material could be called *Calypogeia neogaea* (R.M.Schust.) Bakalin, regional specimens are more like European subsp. *fissa* than subsp. *neogaea* as described by Schuster. Its oil bodies are botryoidal and the capsule cell wall thickenings are different from either of the subspecies of *C. fissa*. We suspect a cryptic species is present. Until more detailed studies are performed, no new species or subspecific name has been proposed.

Specimen cited. **RW**: S side of Taylor Lake, 4 Jul 2006, 6500 ft, *Lenz 3016a* (CAS).

Calypogeia muelleriana (Schiffn.) Müll.Frib.

The closest look-alike is *Calypogeia fissa*. It is largely restricted to soil while *C. muelleriana* is more often growing on rotten wood. Living plants can be distinguished by oil body form, botryoidal in *C. fissa*, but composed of irregular globules in *C. muelleriana*. Dried specimens are reliably identified by comparison with authentic reference specimens.

Specimens cited. **LS**: S end of Ruffey Lake, 16 Oct 2020, 6600 ft, *Shevock 57680a*; **RW**: W of Sugar Lake, 6 Oct 2012, 1830 m, *Kellman & Shevock 6941*, *6944b* (CAS); S end of Taylor Lake, 1 Oct 2020, 6465 ft, *Shevock 57454*; Eaton Lake Trail, 17 Oct 2020, 5700 ft, *Shevock 57731*.

Cephalozia ambigua C.Massal.

This species, treated in some literature as a form or subspecies of *Cephalozia bicuspidata* (L.) Dumort., is characterized by brownish, more cupped, densely packed leaves with smaller cells. It is found primarily in the upper regions of the mountains while typical *C. bicuspidata* occurs mostly at lower elevations.

Specimens cited. **RW**: slope immediately below N side of Russian Lake, 29 Aug 2020, 7020 ft, *Shevock & Magnaghi 57402a*; S end of Taylor Lake, 1 Oct 2020, 6465 ft, *Shevock 57456*, *57466a*.

Cephalozia bicuspidata (L.) Dumort.

One of the most common liverworts; it is most luxuriant on rotting wood near the coast. It is more frequently on peaty substrates and on wet rocks higher in the mountains.

Specimens cited. **RW**: S end of Taylor Lake, 4 Jul 2006, 6500 ft, *Lenz 3016*, *3017*, *3018* (CAS); stream above Sugar Lake, 6 Oct 2012, 1830 m, *Kellman & Shevock 6940b* (CAS).

Cephalozia lunulifolia (Dumort.) Dumort.

This liverwort is frequently found on rotting wood, typically mixed with other liverworts and mosses. It is distinguished by thickened cell walls at the tip of the apical cell of its leaf lobes.

Specimens cited. **LS**: South Russian Creek Trail less than 0.5 mi below the wilderness boundary, 3 Oct 2020, 5000 ft, *Shevock & York 57511*; Mill Creek off county road 1C01, 5 mi SW of Etna, 15 Oct 2020,

3950 ft, *Shevock* 57623; forest road 41N14, 0.1 S of Paynes Lake Trailhead, 18 Oct 2020, 4350 ft, *Shevock* 57769.

Cephalozia pleniceps (Austin) Lindb.

This species is very similar to *Cephalozia lunulifolia*, which is widespread at lower elevations. This collection was found at a higher elevation than any of the collections of *C. lunulifolia*. The evenly thickened cell wall around the terminal cells of leaf lobes is a good diagnostic feature.

Specimens cited. **RW**: slope above Sugar Lake, 6 Oct 2012, 6000 ft, *Kellman & Shevock* 6940a, 6942 (CAS).

Cephaloziella divaricata (Sm.) Schiffn.

This species has the broadest tolerance of substrates and habitats of any liverwort in North America. It is found from coastal forests through alpine vegetation zones to arid inland grasslands. It grows on almost any substrate, organic and inorganic, saturated to seasonally desiccated. In the project area, it prefers thin soil over rock and when dry it forms black thickened mats.

Specimens cited. **LS**: forest road 41N14, 0.4 mi S of Paynes Lake Trailhead, 18 Oct 2020, 4275 ft, *Shevock* 57779; Trail Creek above forest road 39N06 from county road 1C02, 28 Oct 2020, 4850 ft, *Shevock* 57806; North Russian Creek off county road 1C01, 4.7 mi W of Etna Summit, 2 Dec 2020, 3490 ft, *Shevock* 57929; **RW**: outlet of Little Duck Lake, 3 Jul 2020, 6550 ft, *Shevock & Magnaghi* 56936; S end of Taylor Lake, 15 Oct 2020, 6650 ft, *Shevock* 57656.

Chiloscyphus pallescens (Ehrh. ex Hoffm.) Dumort.

The identification of *Chiloscyphus* Corda species relies heavily on oil body characteristics, but unfortunately they disappear soon upon drying. Most collections cited here either had oil bodies present to be confident of the identification or a habitat adjacent to, but not perennially submerged in streams.

Specimens cited. **LS**: end of 1.3 mi spur road to Little Jackson Creek off of county road 1C02 near Carter Meadows Summit, 13 Jun 2020, 5575 ft, *Shevock* 56772; forest highway 39, 2.7 mi E of junction with forest road 39N58, 27 Oct 2020, 5700 ft, *Shevock* 57853; North Fork Russian Creek off of county road 1C01, 4.7 mi W of Etna, 2 Dec 2020, 3490 ft, *Shevock* 57925, 57931.

Chiloscyphus polyanthos (L.) Corda

This is a rheophytic species that normally is completely submerged in the stream bed of perennial streams. Being found submerged, not merely below the high water level, is reasonable justification for naming collections if oil bodies were not present in herbarium specimens.

Specimens cited. **LS**: North Russian Creek along county road 1C01, 4 mi W of Etna Summit, 27 Aug 2020, 3840 ft, *Shevock* 57335; Meeks Meadow Creek, 16 Oct 2020, 6225 ft, *Shevock* 57715; forest road

41N14 at Wildcat Creek, 28 Oct 2020, 4960 ft, *Shevock* 57895.

Clevea hyalina (Sommerf.) Lindb.

[*Athalamia hyalina*]

The most distinguishing feature is the position of the carpocephalum in the center of the thallus, not developing from the apex or margin. Long, white scale appendages at the thallus apex are a good diagnostic feature for sterile plants. This species has often been treated as *Athalamia hyalina* (Sommerf.) S.Hatt., in recent literature, as in Doyle and Stotler (2006).

Specimen cited. **RW**: slope above South Sugar Lake, 31 Aug 1974, 6000 ft, *Norris & McGrew* 45610 (det. confirmed by Alan Whittemore). The collection cited in McGrew (1976) as 45602 for this species was transcribed incorrectly from the adjacent species entry.

Conocephalum conicum (L.) Dumort.

The species we have in the Pacific Northwest is a microspecies similar to, but not identical with, *Conocephalum salebrosum* Szweyk, Buczk. & Odrzyk. (Szweykowski et al. 2005). According to Miwa et al. (2009), our plants belong to the cryptic “species C”, not formally named, which is restricted to Pacific North America. Cryptic “species S”, *Conocephalum salebrosum*, is found widely in Europe and Asia, but known in North America from only a single accession (Miwa et al. 2009). Cryptic “species A”, also unnamed, is restricted to eastern North America. Because the genotype that occurs along the west coast, “species C” (Miwa et al. 2009), has not been formally described, our material should be referred to simply as *Conocephalum conicum* s. l.

Specimen cited. **RW**: S end of Taylor Lake, 1 Oct 2020, 6465 ft, *Shevock* 57464.

Diplophyllum obtusifolium (Hook.) Dumort.

This liverwort prefers soil, in contrast to its closest look-alike *D. taxifolium* (Wahlenb.) Dumort., which usually grows on rocks and cliffs. Sterile plants may be distinguished by reddish color in *D. obtusifolium*, lacking in *D. taxifolium*, and absence of gemmae, frequent in *D. taxifolium*.

Specimen cited. **RW**: slope above South Sugar Lake, 31 Aug 1974, 6000 ft, *Norris & McGrew* 45614 (det. confirmed by Alan Whittemore).

Fossombronia sp.

This simple thalloid liverwort is only readily observed early in the year in the lower elevations of the project area when soil is moist. The genus can be recognized by purplish-red rhizoids, while stem and leaves are pure green. Although only two species of *Fossombronia* are reported for California, they are not readily distinguished without mature spores (Doyle and Stotler 2006). Of the two, *Fossombronia longiseta* (Austin) Austin is the more common species, and based on the habitat in the project area where it occurs, most likely is this species.

Specimens cited. **LS**: county road 1C01 at road marker 22, paralleling North Russian Creek, 0.5 mi below bridge crossing, 23 Mar 2021, 2775 ft, *Shevock 58154*; county road 1C02, 3 mi W of Sixmile Creek, 8 Apr 2021, 3030 ft, *Shevock 58314*.

Frullania bolanderi Austin

The beautiful, lush colonies of this species seen in specimens in the study area are notable. It tends to grow in slender, spidery strands tightly attached to smooth bark that looks like black lines. It is often overlooked because it is so inconspicuous.

Specimens cited. **LS**: Russian Creek just below forest road 40N54 near confluence with North Fork Salmon River, 16 Oct 2020, 2580 ft, *Shevock 57662*; Shadow Creek off county road 1C02, 27 Oct 2020, 3270 ft, *Shevock 57833*; North Fork Russian Creek off county road 1C01, 4.7 mi W of Etna Summit, 2 Dec 2020, 3490 ft, *Shevock 57923*; Whites Gulch Creek along forest road 40N61, 0.5 mi from North Fork Salmon River, 2 Dec 2020, 2500 ft, *Shevock 57954*.

Jungermannia atrovirens Dumort.

This is the most common of three very similar rheophytic liverwort species found in western North America that are essentially confined to sites totally submerged at all times; the other two are *Jungermannia eucordifolia* Schljakov and *Solenostoma schusterianum*. It is characterized by pale green color and ovate to oval leaf shapes, not rounded triangular.

Specimen cited. **RW**: above Sugar Lake on granitic bedrock of stream with cascades, 6 Oct 2012, 5975 ft, *Shevock & Kellman 41170* (det. by Vadim Bakalin).

Jungermannia eucordifolia Schljakov

[*Jungermannia exsertifolia* ssp. *cordifolia*]

This name was not recognized at all in Söderström et al. (2016). Stotler and Crandall-Stotler (2017) recommended using *Jungermannia exsertifolia* subsp. *cordifolia* (Dumort.) Váňa as in Doyle and Stotler (2006). Because there is only this taxon present in North America, the binomial is preferred. However, when elevating this subspecies to species rank within *Jungermannia*, the name *cordifolia* had already been used for a different taxon, therefore, a new name was required.

Specimens cited. **LS**: forest road 41N16 at Little Jackson Creek, 30 Jul 2020, 5200 ft, *Shevock 57105*; North Russian Creek off of county road 1C01, 4 mi W of Etna Summit, 27 Aug 2020, 3840 ft, *Shevock 57335a*; South Russian Creek off of South Russian Creek Trail, 30 Aug 2020, 4690 ft, *Shevock & Magnaghi 57421, 57422*; Mill Creek off of county road 1C01, 5 mi SW of Etna, 15 Oct 2020, 3950 ft, *Shevock 57621*; Duck Lake Creek, forest road 41N14, 0.3 mi S of Duck Lake Trailhead, 18 Oct 2020, 4300 ft, *Shevock 57784*; **RW**: W of Sugar Lake, 6 Oct 2012, 1820 m, *Kellman & Shevock 6936* (CAS); below outlet of Upper Albert Lake, 14 Aug 2020, 7095 ft, *Shevock 57256*.

Liochlaena lanceolata Nees

This liverwort is found around the Northern Hemisphere, always on bark and wood of rotting logs. Fertile plants are distinctive, with smoothly cylindrical perianths, which are sharply contracted at apex with a beaked mouth recessed in the depressed summit. Sterile plants may be recognized, at least tentatively, by slightly retuse leaves.

Specimens cited. **LS**: along Mill Creek off of county road 1C01, 5 mi SW of Etna, 15 Oct 2020, 3950 ft, *Shevock 57622a, 57629*.

Lophocolea coadunata (Sw.) Mont.

This species is found across North America, but only in the western States is it found on logs and bark. It was considered a synonym of *Lophocolea bidentata* (L.) Dumort., in Doyle and Stotler (2006). More recent studies support the distinctiveness of these two, some treating it as *L. cuspidata* (Nees) Limpr. Stotler and Crandall-Stotler (2017) explain that *L. coadunata* is an older name for *L. cuspidata*, and therefore, has priority.

Specimens cited. **LS**: along Mill Creek off of county road 1C01, 5 mi SW of Etna, 15 Oct 2020, 3950 ft, *Shevock 57629a*; **RW**: Sugar Lake Trail, 6 Oct 2012, 1717 m, *Kellman & Shevock 6912* (CAS).

Lophocolea heterophylla (Schrad.) Dumort.

This liverwort is aptly named because it typically has both bidentate and entire leaves on the same shoot. If bidentate leaves are noticed, this is easy to identify with a hand-lens in the field. However, in some plants only the smallest, juvenile leaves will be bidentate, with most leaves being entire to merely retuse.

Specimen cited. **RW**: S end of Taylor Lake, 1 Oct 2020, 6465 ft, *Shevock 57450*.

Lophozia longidens (Lindb.) Macoun

This represents the first collection of this species for California. It is recognized by deeply lobed leaves, red, angular, bi-cellular gemmae, often clustered on erect shoots. This collection was obtained from the base of an *Abies* trunk. See Wagner (2021c) for additional information and photographs.

Specimen cited. **RW**: Paynes Lake Trail just above creek crossing about 0.5 mi from junction with the Pacific Crest Trail, 14 Aug 2020, 6000 ft, *Shevock 57242*.

Lophozia obtusa (Lindb.) A. Evans

This collection represents the first confirmed occurrence in California. Although it was reported in the literature in 1942 from two Sierra Nevada collections made by J.T. Howell in Madera County, those collections were subsequently examined and determined to be misidentified (Doyle and Stotler 2006). Although the collection *Lenz 3014* is fifteen years old, oil bodies could be seen in leaves hydrated without wetting agents. There were numerous, globular oil bodies smaller than the chloroplasts, a characteristic of species treated in the genus *Schistochilopsis* (N. Kitag.) Konstant. Because molecular studies demonstrated considerable genetic distance, Stotler

and Crandall-Stotler (2017) recommended using the alternate monospecific name *Obtusifolium obtusum* (Lindb.) S.W.Arnell. In this case we prefer retention in *Lophozia*, as in the liverwort volume of *Flora of North America North of Mexico* (vol. 29, in prep.). See Wagner (2021d) for additional information and photographs.

Specimens cited. **RW**: S end of Taylor Lake, 4 Jul 2006, 6500 ft, *Lenz 3014, 3017* (CAS).

Lophozia sudetica (Nees ex Huebener) Grolle

Shallowly bilobed leaves coupled with abundant reddish-brown gemmae are the key field characters. Stotler and Crandall-Stotler (2017) have accepted placement in *Barbilophozia* Loeske on the basis of a cladistic analysis (Söderström et al. 2010). However, the treatment of *Barbilophozia* in the liverwort volume of *Flora of North America North of Mexico* (vol. 29, in prep.) excludes it, but places *L. sudetica* in a fairly broad concept of *Lophozia*.

Specimens cited. **RW**: S side of Little Duck Lake, 3 Jul 2020, 6550 ft, *Shevock & Magnaghi 56941*; slopes above Statue Lake less than 0.5 mi above the Pacific Crest Trail, 2 Oct 2020, 7200 ft, *Shevock & York 57482*.

Lophozia ventricosa (Dicks.) Dumort. var. **longiflora** (Nees) Macoun

[*Lophozia longiflora*]

Two varieties of *Lophozia ventricosa* listed here have often been treated as distinct species. Doyle and Stotler (2006) used *Lophozia longiflora* Nees while in older works *L. guttulata* (Lindl. ex Arnell) A.Evans referred to this or a third species. Oil body number is quite variable, but plants with an average of less than 10 oil bodies are typical of this variety while var. *ventricosa* typically has more numerous oil bodies, up to 15 per cell. The *longiflora* phenotype is characterized by short, stout perianth teeth. These characters are not always sorted together because molecular studies have shown these to be end points of a range of morphotypes of a single species. A specimen listed here on the basis of long, sharp perianth teeth (*Shevock 57452*) has the high oil body number typical of var. *ventricosa*.

Specimens cited. **RW**: stream above Sugar Lake, 6 Oct 2012, 1830 m, *Kellman & Shevock 6940* (CAS); S end of Taylor Lake, 1 Oct 2020, *Shevock 57452*.

Lophozia ventricosa (Dicks.) Dumort. var. **ventricosa**

Lophozia ventricosa var. *ventricosa* is the most common and widespread species in the genus in the mountainous regions of the Pacific Northwest. It occurs on a variety of substrates, from moist soil and rock to peat and rotting wood, which accounts for a variety of forms. Typical plants are abundantly gemmiferous, more often than var. *longiflora*. One specimen examined has short, stout spines typical of var. *ventricosa*, but a lower than usual average of oil bodies.

Specimens cited. **LS**: N and S end of Ruffey Lake, 16 Oct 2020, 6550 ft, *Shevock 57675, 57693*; **RW**: S side

of Sugar Lake, 20 Jun 2012, 5950 ft, *Shevock 40406* (det. by Vadim Bakalin) and 6 Oct 2012, 1830 m, *Kellman & Shevock 6032, 6944a* (CAS); S side of Little Duck Lake, 3 Jul 2020, 6550 ft, *Shevock & Magnaghi 56938, 56944*; E side of Bingham Lake, 31 Jul 2020, 7050 ft, *Shevock 57136*; along the Pacific Crest Trail less than 0.25 mi S of Paynes Lake, 1 Aug 2020, 6540 ft, *Shevock & Brooks 57173*; Paynes Lake Trail at crossing of Paynes Lake Creek, 14 Aug 2020, 5975 ft, *Shevock 57239*; S end of Taylor Lake, 1 Oct 2020, 6465 ft, *Shevock 57467* and 15 Oct 2020, 6650 ft, *Shevock 57651*; steep slope above Statue Lake less than 0.5 mi from the Pacific Crest Trail, 2 Oct 2020, 7200–7300 ft, *Shevock & York 57487, 57495*; Eaton Lake Trail, 17 Oct 2020, 5675 ft, *Shevock 57722, 57724*; E side of Eaton Lake, 17 Oct 2020, 6625 ft, *Shevock 57740*.

Lophozia wenzelii (Nees) Steph.

This species is very similar to *L. ventricosa*, but has leaf margins incurved making the leaf trough-like. Its oil bodies are not very useful for identification because they are the same range in size, number, and form as that seen in varieties of *L. ventricosa*.

Specimens cited. **LS**: S end of Ruffey Lake, 16 Oct 2020, 6600 ft, *Shevock 57680*; **RW**: slope below N side of Russian Lake, 29 Aug 2020, 7020 ft, *Shevock & Magnaghi 57402*; S end of Taylor Lake, 1 Oct 2020, 6465 ft, *Shevock 57466*; slopes S of Taylor Lake, 15 Oct 2020, 6450–6650 ft, *Shevock 57640, 57653*.

Lophozia sp. 1.

This is a sterile rheophytic specimen with small uniseriate underleaves that cannot be assigned to species at this time.

Specimen cited. **LS**: end of 1.3 mi spur road at Little Jackson Creek off of county road 1C02 about 1 mi from Carter Meadows Summit, 13 Jun 2020, 5575 ft, *Shevock 56772a*.

Mannia gracilis (F.Weber) D.B.Schill & D.G.Long
[*Asterella gracilis*]

This thalloid liverwort is distinguished by globose carpocephala with reticulate-ridged, yellow spores. The spores have a distinctive nipple or boss on the proximal face. This was treated as a species of *Asterella* P.Beauv., until very recently, when molecular analyses showed it is better incorporated into the genus *Mannia* (Schill et al. 2010).

Specimen cited. **RW**: slope above South Sugar Lake, 31 Aug 1974, 6000 ft, *Norris & McGrew 45602* (H; det. by Alan Whittemore). This collection number was transposed from the adjacent species entry in McGrew (1976). It was listed as 45610; near Paynes Lake, 2 Aug 1975, 1880 m, *Norris & Smith 46335* (UC; det. by Alan Whittemore).

Marchantia alpestris (Nees) Burgeff

Marchantia polymorpha L. is considered to include either three species or three subspecies. Doyle and Stotler (2006) did not distinguish among them, referring to *M. polymorpha* in a broad, inclusive

sense. With experience, the three taxa can be reliably distinguished by differences in ventral scale appendages. The ventral scale appendage margins are strongly dentate in *Marchantia alpestris*, but only moderately or entire in the other two regional species (Wagner 2021a). The species rank is used here, as used by Schuster (1992) and Damsholt (2002). When treated as a subspecies, *Marchantia polymorpha* subsp. *montivagans* Bischl. & Boissel.-Dub., can be used. The collections reported as *Marchantia polymorpha* by McGrew (1976) are likely this species.

Specimens cited. **RW**: SW side of Bingham Lake, 31 Jul 2020, 7050 ft, *Shevock* 57145; S end of Taylor Lake, 1 Oct 2020, 6465 ft, *Shevock* 57463.

Marsupella sphacelata (Giesecke ex Lindenb.) Dumort.

This species is often found alongside intermittent streams running over bedrock. The dense colonies of small plants coat the rocks with a black fuzz when they dry out in late summer.

Specimens cited. **RW**: slopes above Big Duck Lake, 13 Oct 1972, 6600 ft, *Norris* 23313 (UC); slope above South Sugar Lake, 31 Aug 1974, 6000 ft, *Norris* & *McGrew* 45597, 45610 (UC); margin of Paynes Lake, 2 Aug 1975, 6000 ft, *Norris* 46372 (UC); S side of Little Duck Lake, 3 Jul 2020, 6550 ft, *Shevock* & *Magnaghi* 56936a, 56942; SW side of Bingham Lake, 31 Jul 2020, 6550 ft, *Shevock* 57149; along the Pacific Crest Trail toward Statue Lake trail junction, 2 Oct 2020, 6925 ft, *Shevock* & *York* 57478; S end of Eaton Lake, 17 Oct 2020, 6625 ft, *Shevock* 57750.

Pellia alpicola R.M.Schust. ex L.Söderstr., A.Hagborg & vonKonrat

This species is distinguished by uniseriate slime papillae composed of more than two cells. Originally named *Pellia endiviifolia* (Dicks.) Dumort. subsp. *alpicola* R.M.Schust., recent phylogenetic studies have demonstrated it is distinct from other members of the *Pellia endiviifolia* complex. The original name proposed by Schuster (1991) was not validly published (no type specimen cited), so it was subsequently validated by Söderström et al. (2013), but at the species level.

Specimens cited. **RW**: stream above Sugar Lake, 6 Oct 2012, 1815 m, *Kellman* & *Shevock* 6927, 6930 (CAS); South Russian Creek between wilderness boundary and the switchbacks, 3 Oct 2020, 5300 ft, *Shevock* & *York* 57535.

Pellia neesiana (Gottsche) Limpr.

In the field, this species is recognized by succulent, fleshy, forking thalli with sex organs on separate plants. Sterile plants cannot be distinguished from *Pellia epiphylla* (L.) Corda, so *Shevock* 57639 could be this. However, according to Doyle and Stotler (2006), *Pellia epiphylla* has not been confirmed for California.

Specimens cited. **RW**: S end of Taylor Lake, 1 Oct 2020, 6465 ft, *Shevock* 57462 and 15 Oct 2020, *Shevock* 57639.

Plagiochila porelloides (Torr. ex Nees) Lindenb.

This species occurs along streambanks and springs in the project area. The S-shaped insertion of the leaves gives this species a distinctive appearance. An unusual feature of this species is their individuality of leaf margins, entire in some populations to strongly dentate in others. Due to this leaf variability, in the past it has been called *Plagiochila asplenoides* (L.) Dumort., a species not found in California, and *Plagiochila satoi* S.Hatt., which is a synonym of *P. porelloides* (Stotler and Crandall-Stotler 2017).

Specimens cited. **LS**: Mill Creek along county road C101, 5 mi SW of Etna, 27 Aug 2020, 3950 ft, *Shevock* 57316; Meeks Meadow Creek, 16 Oct 2020, 6225 ft, *Shevock* 57714; forest road 41N14, 0.1 mi S of Paynes Lake Trailhead, 18 Oct 2020, 4350 ft, *Shevock* 57764; **RW**: South Russian Creek between wilderness boundary and trail switchbacks, 3 Oct 2020, 5300 ft, *Shevock* & *York* 57521 and 5700 ft, *Shevock* & *York* 57551; Eaton Lake Trail, 17 Oct 2020, 5700 ft, *Shevock* 57726.

Porella cordaeana (Huebener) Moore

Porella cordaeana is characterized by long decurrent underleaves and lobules whose margins are wavy, appearing ruffled near insertion. Underleaves are typically widely spaced so that the stem is visible between them. It is noticeably darker green in the field than *P. navicularis* (Lehm. & Lindenb.) Pfeiff., which usually has a more yellowish tinge. McGrew (1976) reports several collections of *Porella roellii* Steph., from the study area. *Porella roellii* is dark green like *P. cordaeana* so presuming misidentification is at hand, it is excluded from this list especially since *P. cordaeana* was not listed in her thesis (1976). In the project area, *P. cordaeana* is widespread and prefers shaded rock walls and occasionally can even be on boulders that are seasonally submerged or inundated.

Specimens cited. **LS**: forest road 41N16 toward Jackson Lake at tributary of Jackson Creek, 2.4 mi from junction with county road 1C02, 30 Jul 2020, 5780 ft, *Shevock* 57119; North Fork Russian Creek off of county road C101 at bridge crossing 2 mi from North Fork Salmon River, 16 Aug 2020, 3035 ft, *Shevock* 57299; forest road 40N38 along S bank of the N fork Salmon River, 4 Oct 2020, 2410 ft, *Shevock* 57596; Mill Creek off of county road 1C01, 5 mi SW of Etna, 15 Oct 2020, 3950 ft, *Shevock* 57626; Trail Creek above forest road 39N06, 26 Oct 2020, *Shevock* 57809; Sixmile Creek above county road 1C02, 26 Oct 2020, 4025 ft, *Shevock* 57821; Shadow Creek off of county road 1C02, 27 Oct 2020, 3270 ft, *Shevock* 57834; forest road 41N14 at Wildcat Creek, 28 Oct 2020, 4960 ft, *Shevock* 57900; North Russian Creek of county road 1C01, 4.7 mi W of Etna Summit, 2 Dec 2020, 3490 ft, *Shevock* 57933; county road 1C01 at Robinson Gulch, 1.6 mi above junction with forest road 41N61, 25 Feb 2021, 2635 ft, *Shevock* 57979; **RW**: above Sugar Lake on wall of

granitic boulder, 6 Oct 2012, 5975 ft, *Shevock & Kellman 41177*; N side of Russian Lake below lake outlet, 29 Aug 2020, 7020 ft, *Shevock & Magnaghi 57407*; South Russian Creek between wilderness boundary and trail switchbacks, 3 Oct 2020, 5300 ft, *Shevock & York 57529*; Sugar Creek about 0.5 mi above forest road 41N14, 28 Oct 2020, 4920 ft, *Shevock 57884*.

Porella navicularis (Lehm. & Lindenb.) Pfeiff.

Endemic to western North America, this is one of the most prominent leafy liverworts at low to mid elevations. It is distinguished by the tight curl on the margins of the underleaves and lobules. *Porella navicularis* is noticeably more yellowish green in the field than *P. cordaeana*, which is dark green. In the project area, *P. navicularis* is restricted to riparian corridors in the lower elevations, especially on hardwood trunks.

Specimens cited. **LS**: Shadow Creek off of county road 1C02, 27 Oct 2020, 3270 ft, *Shevock 57830*; Whites Gulch Creek along forest road 40N61, 0.5 mi from North Fork Salmon River, 2 Dec 2020, 2500 ft, *Shevock 57953*.

Ptilidium californicum (Austin) Underw. & O.F.Cook
This liverwort is rarely encountered in the Russian Wilderness area, where it occurs on the base of large *Abies* and *Pseudotsuga* trunks in forests with vegetative ground cover. Although this is a highly distinctive plant that would not readily be confused with any other liverwort in the study area, it occurs as very small patches that are easy to overlook.

Specimen cited: **RW**: South Russian Creek Trail at the wilderness boundary, 3 Oct 2020, 5195 ft, *Shevock & York 57517*.

Radula complanata (L.) Dumort.

This liverwort has incubous leaves with ventral lobules and no underleaves. These plants have a characteristic pale, whitish green color. They form flat colonies on smooth surfaces, usually tree bark, with abundant rhizoids that keep it prostrate. However, in the study area this species was collected only once fused to boulders, where it is seasonally submerged to inundated.

Specimen cited. **RW**: Duck Lake Creek at trail junction to Eaton Lake and Duck Lakes, 17 Oct 2020, 5675 ft, *Shevock 57757*.

Riccardia multifida (L.) Gray

This species is characterized by a thin, narrow, bright green thallus that is regularly pinnately branched like a pine tree. Its most distinguishing feature is a unistratose margin that is two or three cells wide, with oil bodies absent from most of the marginal cells. This species is infrequent at these elevations; it is much more common at lower elevations and near the coast. It prefers perennially wet sites.

Specimen cited. **RW**: Taylor Creek below outlet of Taylor Lake, 2 Aug 2020, 6400 ft, *Shevock & Brooks 57193*.

Riccia beyrichiana Hampe ex Lehm.

This is a thalloid liverwort with a shallow, flat groove between swollen, raised margins. When plants are well developed, marginal cilia help characterize the species. In the project area, plants are best observed on seasonally moist soil shortly after snowmelt. After spores have matured, thalli quickly shrivel or disintegrate and are hard to notice.

Specimen cited. **RW**: slope above South Sugar Lake, 31 Aug 1974, 6000 ft, *Norris & McGrew 45611* (H; det. by Alan Whittemore).

Riccia nigrella DC.

This species is small, even for a *Riccia* L. Overlapping black ventral scales are diagnostic. When the plants dry out, the sides curl up so that its black undersides are brought together and they look like little black lines in the dust. It grows on bare mineral soil that is moist all winter and can be somewhat weedy.

Specimen cited. **LS**: county road 1C01, 1.5 mi W of North Fork Salmon River Bridge from Idlewild Campground, 25 Feb 2021, 2500 ft, *Shevock 57996*.

Riccia sorocarpa Bisch.

This species has a bright green thallus with a central narrow, deep groove and no cilia on the margin. Mature spores are very dark with small reticulations on the distal face. Its preferred substrate, bare soil, tends to be an ephemeral habitat.

Specimens cited. **LS**: along the Pacific Crest Trail near Smith Lake about 3 mi from Etna Summit, 8 Jul 2003, 2200 m, *Norris & Hillyard 105766* (UC; det. by Bill Doyle); **RW**: slope above South Sugar Lake, 31 Aug 1974, 6000 ft, *Norris & McGrew 45591* (H; det. confirmed by Alan Whittemore).

Scapania americana Müll.Frib.

This common western North American endemic is distinguished by the finely, evenly dentate leaf margins coupled with having both dorsal and ventral lobes long-decurrent. Its strong preference for inorganic substrates—rock and soil—is an important characteristic feature.

Specimen cited. **LS**: Mill Creek off of county road 1C01, 5 mi SW of Etna, 15 Oct 2020, 3950 ft, *Shevock 57619*.

Scapania irrigua (Nees) Nees

Both lobes of this liverwort are non-decurrent, quite round, usually entire. Verification of this specimen is based on observing 3–5 small oil bodies, typical of *S. irrigua*. It is occasional in high mountains, rare below subalpine habitats.

Specimen cited. **LS**: Mill Creek off of county road 1C01, 5 mi SW of Etna, 15 Oct 2020, 3950 ft, *Shevock 57618*.

Scapania subalpina (Nees ex Lindenb.) Dumort.

Subequal lobes coupled with decurrent ventral lobes distinguish this species. Fresh specimens present numerous oil bodies, up to 15 per cell, the highest number reported in the genus. It is not common below subalpine habitats.

Specimens cited. **RW**: S side of Sugar Lake on mucky saturated soil, 20 Jun 2012, 5950 ft, *Shevock 40408* and above Sugar Lake, 6 Oct 2012, 1815 m, *Kellman & Shevock 6925* (CAS); fen just above Albert Lake, 14 Aug 2020, 6940 ft, *Shevock 57259*; steep slope above Statue Lake about 0.5 mi above the Pacific Crest Trail, 2 Oct 2020, 7200 ft, *Shevock & York 57481*; South Russian Creek between wilderness boundary and the switchbacks, 3 Oct 2020, 5300 ft, *Shevock & York 57525a*.

Scapania umbrosa (Schrad.) Dumort.

This is one of the smallest species in the genus, characterized by dentate leaves contrasting an entire perianth mouth (perianths are frequent). The lobes are relatively narrow, tapering, angled only slightly away from the stem, with large teeth for the size of the plants.

Specimens cited. **LS**: along Mill Creek off of county road 1C01, 5 mi SW of Etna, 15 Oct 2020, 3950 ft, *Shevock 57623a, 57629c*.

Scapania undulata (L.) Dumort.

A non-decurrent dorsal lobe coupled with long-decurrent ventral lobe and aquatic or amphibious habitat is characteristic of the species. The variation from finely dentate to completely entire leaf margins in different populations (as in *Plagiochila porelloides*) can be confusing; note that the perianths of this species are always dentate even if the leaf margins are entire. *Scapania undulata* is found on various substrates, invariably near water; at all elevations, widespread in the state. Especially abundant on rocks in flood zone of streams, it is occasionally completely submerged year around.

Specimens cited. **LS**: forest road 41N14 at Horse Range Creek, 0.8 mi S of the Paynes Lake Trailhead, 14 Aug 2020, 4490 ft, *Shevock 57270*; forest road 41N14, 0.1 mi S of Paynes Lake Trailhead, 18 Oct 2020, 4350 ft, *Shevock 57774, 57775*; forest road 41N14, 0.3 mi S of Duck Lake Trailhead at Duck Lake Creek, 18 Oct 2020, 4300 ft, *Shevock 57782*; Sixmile Creek above county road 1C02, 26 Oct 2020, 4025 ft, *Shevock 57825*; forest road 39N20 at Campbell Spring, 27 Oct 2020, 6050 ft, *Shevock 57843*; **RW**: S end of Taylor Lake, 4 Jul 2006, 6500 ft, *Lenz 3039* (CAS); stream just below outlet of Sugar Lake, submerged on granitic boulders, 20 Jun 2012, 5935 ft, *Shevock 40397* and cliffs above Sugar Lake, 6 Oct 2012, 1860 m, *Kellman & Shevock 6935, 6951* (CAS); 1 Oct 2020, 6465 ft, *Shevock 57448, 57455*; along the Pacific Crest Trail from Music Creek at Statue Lake Trail junction, 2 Oct 2020, 6925 ft, *Shevock & York 57477*; South Russian Creek between wilderness boundary and the trail switchbacks, 3 Oct 2020, 5300 ft, *Shevock & York 57525*; Duck Lake Creek at trail junction to Eaton Lake, 17 Oct 2020, 5675 ft, *Shevock 57755*; Sugar Creek about 0.5 mi above forest road 41N14, 28 Oct 2020, 4840 ft, *Shevock 57878*.

Solenostoma schusterianum (J.D. Godfrey & G. Godfrey) Vána, Hentschel & Heinrichs

This species had not been known previously south of Washington State. It could easily be mistaken for *Jungermannia eucordifolia*, a common species in California that also prefers perennial stream in submerged sites. Both species have very similar leaf outlines, broadly triangular with rounded edges. The distinctive features of *S. schusterianum* are a clasping leaf base and abundant flagelliform branches. See Wagner (2021b) for additional information and photographs.

Specimens cited. **RW**: trail about 0.5 mi below Sugar Lake, granitic bedrock of creek, submerged, 6 Oct 2012, 5850 ft, *Shevock & Kellman 41159* (det. by Vadim Bakalin), Duck Lake Creek at trail junction to Eaton Lake, 17 Oct 2020, 5675 ft, *Shevock 57753*.

MOSSES

Amblystegium serpens (Hedw.) Schimp.

This is a species of wet shaded places such as fens or stream banks, often on rotten wood. Sporophytes are usually present and are long, curved, and asymmetric.

Specimens cited. **LS**: Jackson Creek above county road 1C02, 26 Oct 2020, 4500 ft, *Shevock 57789a*; **RW**: slope above South Sugar Lake, 31 Aug 1974, 6000 ft, *Norris & McGrew 45621* (UC); SE side of Taylor Lake, 15 Oct 2020, 6465 ft, *Shevock 57634*.

Amphidium californicum (Hampe ex Müll. Hal.) Broth.

This species prefers rock crevices and overhangs where it rarely receives direct rainfall. The dried leaves are very twisted and contorted and plants form densely packed mats. Capsules are rarely encountered.

Specimens cited. **LS**: along county road 1C01, Mill Creek 5 mi SW of Etna, 27 Aug 2020, 3950 ft, *Shevock 57323*; county road 1C01, 3.8 mi eastward from Etna Summit, 21 Jun 2020, 4300 ft, *Shevock 56915*; county road 1C01 at Taylor Creek above confluence with North Russian Creek, 27 Aug 2020, 3570 ft, *Shevock 57339*; North Fork Salmon River above junction with forest road 40N61, 4 Oct 2020, 2380 ft, *Shevock 57609*; North Fork Salmon River off of county road 1C01 about 2.2 mi SW of Idlewild Campground, 2 Dec 2020, 2550 ft, *Shevock 57946*.

Amphidium lapponicum (Hedw.) Schimp.

Amphidium lapponicum prefers rock crevices and overhangs in subalpine conifer forests. Evidently, this species is rare to uncommon within the Russian Wilderness. Capsules are more common in this species compared with *A. californicum*.

Specimens cited. **RW**: South Sugar Lake, 31 Aug 1974, 6000 ft, *Norris & McGrew 45600, 45633* (UC); slope above Sugar Lake, 25 Jul 1980, 1900 m, *Norris 57419* (UC); slope above Bingham Lake S of Russian Peak, 31 Jul 2020, 7250 ft, *Shevock 57129*.

Anacolia menziesii (Turner) Paris

This is a large and showy species commonly on rock walls. Plants with abundant, dense, reddish-orange tomentum are diagnostic features. Sporophytes are infrequently encountered but when present the capsules are unmistakable by their globose shape.

Specimens cited: **LS**: Taylor Creek along county road 1C01, 27 Aug 2020, 2570 ft, *Shevock* 57337; Sixmile Creek above county road 1C02, 26 Oct 2020, 4025 ft, *Shevock* 57823; forest road 40N54 near Russian Creek Bridge, 2 Dec 2020, 2375 ft, *Shevock* 57960; North Fork Salmon River paralleling county road 1C01, 1.8 mi W of Idlewild Campground, 25 Feb 2021, 2480 ft, *Shevock* 58000; forest road 40N61, 1.7 mi from junction with county road 1C01 and North Fork Salmon River, 25 Mar 2021, 2600 ft, *Shevock* 58165.

Andreaea heinemannii Hampe & Müll.Hal.

This is the most common species of *Andreaea* Hedw., in California and is found occasionally in the Salmon Mountains, but the plants are so small and inconspicuous that it is usually overlooked by most plant enthusiasts. It prefers granitic boulders in mixed conifer forests where the rock surface is not too smooth, either having large quartzite crystals or the rock surface has some crumbly weathering or exfoliation features. This species also produces frequent sporophytes shaped like a Chinese lantern, but they are only seen with a hand-lens. It is generally difficult to collect due to its small size because the plants are often wedged between the rock crystals. It is more commonly encountered on granitic boulders in the mid elevation conifer forest zone just below the wilderness boundary. When in a dry state the plants are quite blackish-purple in color and it can superficially resemble a *Grimmia* when growing in mixed colonies, but it lacks a hair point and the leaves are falcate. Additionally, the leaves have a costa, but it is weak or lacking basally.

Specimens cited: **LS**: Paynes Lake Trail near the wilderness boundary, 14 Aug 2020, 5600 ft, *Shevock* 57265; forest road 39N06 above Trail Creek just N of county road 1C02, 26 Oct 2020, 4850 ft, *Shevock* 57800a; **RW**: along trail to Sugar Lake, 20 Jun 2012, 5700 ft, *Shevock* 40414; old road bed (now a trail) toward Big Duck Lake near trail junction to Eaton Lake, 3 Jul 2020, 5550 ft, *Shevock* & *Magnaghi* 56981; E slope of Eaton Lake, 17 Oct 2020, 6625 ft, *Shevock* 57738.

Andreaea nivalis Hook.

This is the first record of this species for the Klamath Ranges. In Norris and Shevock (2004a), this species was only reported from Lassen Volcanic National Park. Subsequently, it was located in alpine areas of the Sierra Nevada within Yosemite and Sequoia-Kings Canyon National Parks. The Russian Wilderness occurrence is on granitic rock, whereas the other California populations are on volcanic or metavolcanic rock. The plants are reddish-brown and have leaves with serrulate upper margins.

Specimens cited. **RW**: slopes above Bingham Lake, 31 Jul 2020, 7200 ft, *Shevock* 57150; steep slopes above Statue Lake, 2 Oct 2020, 7400 ft, *Shevock* & *York* 57496.

Andreaea rupestris Hedw.

Contrasted with *Andreaea heinemannii*, this species is larger and has ecostate, ovate to oblong-lanceolate leaves with obtuse apices.

Specimens cited. **RW**: about Paynes Lake, 2 Aug 1975, 6000 ft, *Norris* & *Smith* 46353 (UC); slopes above the S side of Taylor Lake, 19 Aug 1994, 1950 m, *Norris* 83415 (UC); along South Russian Creek trail at the wilderness boundary, 3 Oct 2020, 5195 ft, *Shevock* & *York* 57513.

Antitrichia californica Sull. ex Lesq.

This is perhaps the most widespread moss in California based on both distribution and biomass where it prefers to occupy areas below a prolonged snowpack. It is most common on hardwood trees, but it can shift to boulders, especially at higher elevations.

Specimens cited: **LS**: county road 1C01, 4.9 mi SW of Etna Summit, 31 Aug 2020, 3590 ft, *Shevock* 57162; county road 1C01, North Russian Creek, 2 mi E of North Fork Salmon River bridge, 16 Aug 2020, 3035 ft, *Shevock* 57306; county road 1C02 at Sixmile Creek, 27 Oct 2019, 3995 ft, *Shevock* & *Liu* 55474; county road 1C02 at Shadow Creek, 13 Jun 2020, 2870 ft, *Shevock* 56791; forest road 39N48 above Carter Meadows Summit, 13 Aug 2020, 6400 ft, *Shevock* 57284; forest highway 39, 0.6 mi from junction with county road 1C02, 27 Oct 2020, 4130 ft, *Shevock* 57857; county road 1C01 at junction with forest road 40N61 above the North Fork Salmon River, 25 Feb 2021, 2470 ft, *Shevock* 57978.

Atrichum selwynii Austin

This species occurs on both loamy soils with litter and bare mineralized soils in the lower elevations of the study area. It is most common on road banks and stream banks in filtered light. The leaves of dry plants are very twisted and contorted and sporophytes are uncommon.

Specimens cited: **LS**: forest road 41N14 at Paynes Creek, 2 Aug 1975, 5500 ft, *Norris* & *Smith* 46283 (UC); county road 1C02 at Shadow Creek, 13 Jun 2020, 2870 ft, *Shevock* 56794; Mill Creek, county road 1C01, 5 mi W of Etna, 15 Oct 2020, 3950 ft, *Shevock* 57620; county road 1C01, 3.2 mi W of Etna Summit just below Jumpoff Joe Curve and above spring, 2 Dec 2020, 4125 ft, *Shevock* 57905; forest road 40N61, 1.7 mi from junction with county road 1C01 and North Fork Salmon River, 25 Mar 2021, 2600 ft, *Shevock* 58166; **RW**: South Russian Creek Trail at the switchbacks, 3 Oct 2020, 5570 ft, *Shevock* & *York* 57546.

Aulacomnium androgynum (Hedw.) Schwägr.

This species is common to abundant on rotten logs, charred wood and occasionally on soil with decaying wood and humus. It can also occur infrequently on

boulders with some needle litter. Gemmae are borne in globose clusters at the end of naked stalks and are highly diagnostic. Sporophytes are occasional.

Specimens cited: **LS**: forest road 41N14 at Sugar Creek, 20 Jun 2012, 4775 ft, *Shevock 40418*; county road 1C01, 4.9 mi W of Etna Summit, 31 Jul 2020, 3590 ft, *Shevock 57159*; South Russian Creek Trail, 30 Aug 2020, 4650 ft, *Shevock & Magnaghi 57417*; Jackson Creek above county road 1C02, 26 Oct 2020, 4500 ft, *Shevock 57790*; confluence of North Russian and South Russian Creeks, 25 Feb 2021, 2665 ft, *Shevock 57986*; **RW**: just below outlet of Sugar Lake, 20 Jun 2012, 5935 ft, *Shevock 40394*; trail below junction of Big Duck and Little Duck Lake, 3 Jul 2020, 5800 ft, *Shevock & Magnaghi 56976*; along trail between Taylor Lake and Hogan Lake, 28 Aug 2020, 6030 ft, *Shevock & Magnaghi 57353*; South Russian Creek Trail at the switchbacks, 3 Oct 2020, 5570 ft, *Shevock & York 57541*; Eaton Lake Trail, 17 Oct 2020, 6450 ft, *Shevock 57736*.

Aulacomnium palustre (Hedw.) Schwägr.

Common along lake margins, seeps, and fens. Plants are rather yellowish in appearance and the whitish coloration of the costa on the dorsal side of the leaves is diagnostic. In addition, the lower parts of the plants are clothed with dense reddish-brown tomentum. Sporophytes are rarely produced in California. Specimens cited: **RW**: Sugar Lake Trail below Sugar Lake, 20 Jun 2012, 5680 ft, *Shevock 40375*; outlet of Little Duck Lake, 3 Jul 2020, 6550 ft, *Shevock & Magnaghi 56934*; east shore of Bingham Lake, 31 Jul 2020, 7050 ft, *Shevock 57135*; Albert Lake, 1 Aug 2020, 6940 ft, *Brooks & Shevock 4070* (CAS); Upper Albert Lake, 14 Aug 2020, 7165 ft, *Shevock 57252*; slope between Waterdog and Russian Lakes, 29 Aug 2020, 7000 ft, *Shevock & Magnaghi 57397*; S end of Taylor Lake, 1 Oct 2020, 6465 ft, *Shevock 57444*; South Russian Creek Trail above switchbacks, 3 Oct 2020, 5745 ft, *Shevock & York 57552*, and fen at headwaters of South Russian Creek, 3 Oct 2020, 6115 ft, *Shevock & York 57557*.

Bartramia ithyhylla Brid.

This species is found in the subalpine region of the study area in rock crevices with some soil or about overhanging rock ledges. It can occur mixed with other species, and therefore, it is more readily noticed when capsules are present. The whitish sheathing leaf bases are unique among the three *Bartramia* Hedw., species known from California.

Specimens cited: **RW**: above Sugar Lake, 6 Oct 2012, 5975 ft, *Shevock & Kellman 41175*; SW slope above Bingham Lake, 31 Jul 2020, 7200 ft, *Shevock 57151*; along the Pacific Crest Trail just south of Paynes Lake, 1 Aug 2020, 6540 ft, *Shevock & Brooks 57170*; steep slopes above Statue Lake, 2 Oct 2020, 7200 ft, *Shevock & York 57484*.

Bartramia pomiformis Hedw.

The pale glaucous green cushions of this moss can be several centimeters tall. The leaves are curled when

dry and the capsules are similar to those of *Anacolia* Schimp., but are ridged when old.

Specimen cited: **LS**: along Mill Creek off of county road 1C01, 5 mi SW of Etna, 15 Oct 2020, 3950 ft, *Shevock 57617*.

Blindia acuta (Hedw.) Bruch & Schimp.

This species is generally on boulders located along streams and intermittent rivulets, where it is usually seasonally submerged during snowmelt. Although it can occur on partially shaded granitic rock walls that stay moist for extended periods within subalpine areas. The orange colored base of the leaves at stem attachment can be observed with a hand-lens. Also diagnostic are the narrow falcate leaves, which have a glossy blackish-green appearance.

Specimens cited: **LS**: county road 1C01 at Mill Creek, 5 mi SW of Etna, 27 Aug 2020, 3950 ft, *Shevock 57312*; N side of Upper Ruffey Lake below lake outlet, 16 Oct 2020, 6550 ft, *Shevock 57691*; **RW**: near Taylor Lake, 19 Aug 1974, 1950 m, *Norris 83410* (UC); slopes above Bingham Lake, 31 Jul 2020, 7250 ft, *Shevock 57128*; along trail below outlet of Taylor Lake, 2 Aug 2020, 6400 ft, *Shevock & Brooks 57212* and *Brooks & Shevock 4084* (CAS); along Paynes Lake Trail above crossing of Paynes Lake Creek, 14 Aug 2020, 6000 ft, *Shevock 57241*; South Russian Creek Trail at switchbacks, 3 Oct 2020, 5570 ft, *Shevock & York 57545*; Sugar Creek about 0.5 mi above forest road 41N14, 28 Oct 2020, 4840 ft, *Shevock 57881*.

Brachytheciastrum collinum (Schleich. ex Müll.Hal.) Ignatov & Huttunen

[*Brachythecium collinum*]

This species prefers rock crevices and terraces. The plants are very small with leaves densely arranged along the shoots. When dry the plants resemble little mouse tails. Sporophytes are occasional.

Specimens cited: **LS**: along forest road 39N48 above Carter Meadows Summit, 15 Aug 2020, 6400 ft, *Shevock 57288*; **RW**: slopes above Bingham Lake, 31 Jul 2020, 7250 ft, *Shevock 57127*, *57130*, *57131*; Upper Albert Lake, 14 Aug 2020, 7165 ft, *Shevock 57251*; between Taylor Lake and Hogan Lake, 28 Aug 2020, 6000 ft, *Shevock & Magnaghi 57351*; Pacific Crest Trail S of junction with trail to Statue Lake, 2 Oct 2020, 6950 ft, *Shevock & York 57499*, *57502*.

Brachytheciastrum leibergii (Grout) Ignatov & Huttunen

[*Brachythecium leibergii*]

This is the most robust species in this genus in the area and is recognized by its falcate and plicate leaves.

Specimens cited: **LS**: trail between Upper Ruffey Lake and Meeks Meadow Lake, 16 Oct 2020, 6440 ft, *Shevock 57700*; **RW**: Bingham Lake, 1 Sep 1974, 6500 ft, *Norris & McGrew 45657* (UC); Paynes Lake Trail at crossing of Paynes Lake Creek, 14 Aug 2020, 5975 ft, *Shevock 57235*; along trail between Taylor

Lake and Hogan Lake, 28 Aug 2020, 6030 ft, *Shevock & Magnaghi 57357* and ridge above Taylor Lake toward Hogan Lake, 28 Aug 2020, 6870 ft, *Shevock & Magnaghi 57386*.

***Brachytheciastrum velutinum* (Hedw.) Ignatov & Huttunen**

[*Brachythecium velutinum*]

This common species mostly grows on duff and the bases of conifers and is usually found with sporophytes.

Specimens cited. **LS:** county road 1C01, 3.8 mi eastward from Etna Summit, 21 Jun 2020, 4300 ft, *Shevock 56913*; Jackson Creek just above county road 1C02, 26 Oct 2020, 4500 ft, *Shevock 57791*; off of forest road 39N06 below crossing of Trail Creek, 26 Oct 2020, 4850 ft, *Shevock 57816*; Shadow Creek off of county road 1C02, 27 Oct 2020, 3270 ft, *Shevock 57835* and 8 Apr 2021, *Shevock 58318*; forest road 41N14 at Wildcat Creek, 28 Oct 2020, 4960 ft, *Shevock 57894*; confluence of North Russian and South Russian Creeks, 25 Feb 2021, 2665 ft, *Shevock 57991*; **RW:** along trail to Little Duck Lake above junction with Big Duck Lake, 3 Jul 2020, 6500 ft, *Shevock & Magnaghi 56968*; along the Pacific Crest Trail just south of Paynes Lake, 1 Aug 2020, 6540 ft, *Shevock & Brooks 57166, 57172*; Paynes Lake Trail between crossing of Paynes Lake Creek and junction with the Pacific Crest Trail, 14 Aug 2020, 6200 ft, *Shevock 57247*; South Russian Creek Trail between wilderness boundary and switchbacks, 3 Oct 2020, 5285 ft, *Shevock & York 57518* and at the switchbacks 57538; Eaton Lake Trail, 17 Oct 2020, 5675 ft, *Shevock 57720*; Duck Lake Creek at junction with Eaton Lake Trail, 17 Oct 2020, 4675 ft, *Shevock 57752*.

***Brachythecium albicans* (Hedw.) Schimp.**

This is the most common species of *Brachythecium* Schimp., in the area within the mixed conifer zone. Plants generally form large pale to medium green patches with needle litter over boulders. Sporophytes are rather rare.

Specimens cited. **LS:** off of county road 1C01, North Fork Russian Creek, 2 mi from North Fork Salmon River Bridge, 16 Aug 2020, 3035 ft, *Shevock 57302*; forest road 41N16 at crossing of Little Jackson Creek, 30 Jul 2020, 5200 ft, *Shevock 57109*; South Russian Creek Trail less than 0.25 mi from the trailhead, 30 Aug 2020, 4650 ft, *Shevock & Magnaghi 57416*; forest road 39N06 just above crossing of Trail Creek, 26 Oct 2020, 4850 ft, *Shevock 57810*; Shadow Creek just below county road 1C02, 27 Oct 2020, 3270 ft, *Shevock 57835*; **RW:** Sugar Creek, 18 Aug 1974, 5800 ft, *McGrew 0059* (UC); trail below Sugar Lake, 20 Jun 2012, 5700 ft, *Shevock 40412*, south side of Sugar Lake, 20 Jun 2020, 5950 ft, *Shevock 40403*; Paynes Lake Trail and crossing of Paynes Lake Creek, 14 Aug 2020, 5975 ft, *Shevock 57236*; South Russian Creek Trail at wilderness boundary, 3 Oct 2020, 5195 ft, *Shevock & York 57515*.

***Brachythecium asperrimum* (Müll.Hal.) Sull.**

This *Brachythecium* has narrower leaves and more decurrent leaf bases than the similar *B. frigidum*. It prefers soil, rotten logs, and tree bases, whereas *B. frigidum* (Müll.Hal.) Besch., is a plant of much wetter places.

Specimens cited. **LS:** forest road 41N14 at Paynes Creek, 2 Aug 1975, 5500 ft, *Norris & D. Smith 46302* (UC); county road 1C01 at Robinson Gulch, 1.6 mi above junction with forest road 41N61, 25 Feb 2021, 2635 ft, *Shevock 57981*; **RW:** South Russian Creek Trail at the switchbacks, 3 Oct 2020, 5570 ft, *Shevock & York 57542*.

***Brachythecium erythrorrhizon* Schimp.**

This species might be confused with *Brachytheciastrum leibergii*, but is more robust and has less serrulate leaf margins.

Specimens cited. **RW:** Sugar Creek, 18 Aug 1973, 5800 ft, *McGrew 0057* (UC); Paynes Lake Trail about 0.5 mi below junction with the Pacific Crest Trail, 14 Aug 2020, 5935 ft, *Shevock 57237* and at 6200 ft, *Shevock 57249*; S end of Taylor Lake, 1 Oct 2020, 6465 ft, *Shevock 57453*.

***Brachythecium frigidum* (Müll.Hal.) Besch.**

This common species is basically rheophytic where it carpets boulders and banks that are seasonally submerged. It can also occur in saturated areas, such as springs. It can, however, have several growth forms depending on the duration of submersion or degree of illumination. Sporophytes are uncommon. Specimens cited. **LS:** forest road 41N14 at French Creek, 2 mi N of Sugar Creek Trailhead, 14 Aug 2020, 4195 ft, *Shevock 57275*; trail between Deacon Lee trailhead and Waterdog Lake, 29 Aug 2020, 6840 ft, *Shevock & Magnaghi 57392*; county road C101 at hillside seep, 0.3 mi E of Etna Summit, 1 Oct 2020, 5940 ft, *Shevock 57441*; forest road 41N14, 0.1 mi S of Paynes Lake Trailhead, 18 Oct 2020, 4350 ft, *Shevock 57760*; forest highway 39, 2 mi E of junction with forest road 39N58, 27 Oct 2020, 5920 ft, *Shevock 57852*; county road 1C01 at Cow Creek, above confluence with North Russian Creek, 2 Dec 2020, 3200 ft, *Shevock 57939*; **RW:** S side of Sugar Lake at spring, 20 Jun 2012, 5950 ft, *Shevock 40411* and 6 Oct 2012, 1830 m, *Kellman & Shevock 6939* (CAS); Taylor Lake, 4 Jul 2006, 6500 ft, *Lenz 3020* (CAS); trail below junction to Big Duck and Little Duck Lakes at spring, 3 Jul 2020, 5780 ft, *Shevock & Magnaghi 56978*; streamlet between Albert and Upper Albert Lakes, 1 Aug 2020, 6900 ft, *Shevock & Brooks 57184*; trail to Taylor Lake just below the lake outlet, 2 Aug 2020, 6400 ft, *Shevock & Brooks 57195, 57196*; trail between Taylor Lake and Hogan Lake, 28 Aug 2020, 6030 ft, *Shevock & Magnaghi 57354*; Pacific Crest Trail between Statue Lake and junction with Music Creek Trail, 2 Oct 2020, 6925 ft, *Shevock & York 57474*; Duck Lake Creek at junction with Eaton Lake Trail, 17 Oct 2020, 5675 ft, *Shevock 57756*; Sugar Creek about 0.5 mi above forest road 41N14, 28 Oct 2020, 4840 ft, *Shevock 57875*.

Brachythecium rivulare Bruch & Schimp.

This moss occupies much of the same habitats as *Brachythecium frigidum*, but is far less common in California. Compared to *B. frigidum*, the leaves are more broadly ovate, less acuminate, and not plicate or only slightly so; the alar areas are larger and more distinct.

Specimen cited. **RW**: above Sugar Lake, 25 Aug 1973, 6000 ft, *McGrew 0140* (UC).

Bryoerythrophyllum recurvirostrum (Hedw.) P.C. Chen

This moss, formerly placed in *Didymodon* Hedw., grows in dull, dark green tufts that become rusty red in their lower portions. Microscopically, the basal leaf cells are hyaline, not papillose, and slightly inflated. It is uncommon in the study area, occurring on shaded rock. Sporophytes are infrequent.

Specimen cited. **RW**: Taylor Lake, 4 Jul 2006, 6500 ft, *Lenz 3010* (CAS).

Bryum argenteum Hedw.

This common and cosmopolitan moss is surprisingly uncommon in the project area. It is mostly found on soil in disturbed places and is recognized by its whitish to silvery pale green shoots.

Specimen cited. **LS**: county road 1C01, 0.9 mi NE of junction with forest road 40N61 and about 1.5 mi SW of Idlewild Campground and bridge crossing of North Fork Salmon River, 2 Dec 2020, 2550 ft, *Shevock 57957*.

Bryum blindii Bruch & Schimp.

This collection with abundant red short pyriform capsules appears to be closest to *Bryum blindii* according to John Spence (California Academy of Sciences, personal communication) where he states “this is rather large for *B. blindii/oblongum*, but closest to these species, with a bit of *Imbribryum alpinum* (Huds. ex With.) N.Pedersen thrown in. Some of the spores in capsules were irregular and aborted so there is a slight chance this is a hybrid. Otherwise, it reminds me of a large *B. blindii* with innovation leaves similar to *B. oblongum* Lindl.,—which is weird. The spores are larger than those species, 18–25 µm vs 10–18 µm. Maybe new, but I would need more collections.” These plants dominate a seepage area of granitic gravels among *Juncus* L., and *Philonotis fontana* (Hedw.) Bridl., along an old logging spur road in a *Abies magnifica* forest.

Specimen cited. **LS**: forest road 40N83, just below Bingham Lake Trailhead on slopes well above Jackson Lake, 30 Jul 2020, 6680 ft, *Shevock 57123*.

Bryum calobryoides J.R.Spence

This is a species basically restricted to subalpine conifer forests, where it occurs as very small patches on either rock crevices or on needle litter at base of boulders. The small rounded deep green leaves form a dense cabbage head like arrangement. It is easily recognized with a hand-lens. Sporophytes of this species are unknown (John Spence, California Academy of Sciences, personal communication).

Specimens cited: **LS**: N side of Upper Ruffey Lake just below outlet, 16 Oct 2020, 6550 ft, *Shevock 57687*; forest highway 39, 0.7 mi E of junction with forest road 39N58, 27 Oct 2020, 6025 ft, *Shevock 57846*; **RW**: Big Duck Lake, 13 Oct 1972, 6600 ft, *Norris 23352* (UC); Bingham Lake, 1 Sep 1974, 7000 ft, *McGrew 0627* (UC); Taylor Lake, 4 Jul 2006, 6500 ft, *Lenz 3046* (CAS); slope above Sugar Lake, 6 Oct 2012, 1860 m, *Kellman & Shevock 6950* (CAS); slopes above Bingham Lake, 31 Jul 2020, 7250 ft, *Shevock 57131a*.

Bucklandiella affinis (F.Weber & D.Mohr) Bedn.-Ochyra & Ochyra

[*Racomitrium affine*]

This species has a gray-green coloration and a costal cross section of three cell layers.

Specimens cited: **LS**: county road 1C01 at Taylor Creek just above confluence with North Russian Creek, 4.8 mi W of Etna Summit, 27 Aug 2020, 3570 ft, *Shevock 57344*; South Russian Creek Trail less than 0.5 mi from the trailhead, 30 Aug 2020, 4650 ft, *Shevock & Magnaghi 57413*; forest road 41N14, 0.4 mi S of Paynes Lake Trailhead, 18 Oct 2020, 4275 ft, *Shevock 57777*; forest highway 39. 1.1 mi from junction with county road 1C02, 27 Oct 2020, 4530 ft, *Shevock 57858* and 0.6 mi from county road 1C02, 4130 ft, *Shevock 57861*; **RW**: along trail below Sugar Lake, 6 Oct 2012, 5400 ft, *Shevock & Kellman 41179*; Sugar Creek about 0.6 mi above forest road 41N14, 28 Oct 2020, 4920 ft, *Shevock 57891*.

Bucklandiella heterosticha (Hedw.) Bedn.-Ochyra & Ochyra

[*Racomitrium heterostichum*]

This species is slightly more robust than *B. affinis* and has a more yellow-green coloration. Its costal cross section is of two cell layers.

Specimens cited. **LS**: forest road 41N14 at Sugar Creek, 20 Jun 2012, 4775 ft, *Shevock 40416*; forest road 40N54 just beyond the bridge crossing of Russian Creek, 27 Aug 2020, 2580 ft, *Shevock 57345*; North Fork Salmon River at forest road 40N61, 4 Oct 2020, 2380 ft, *Shevock 57600*; **RW**: Sugar Lake Trail, 6 Oct 2012, 1500 m, *Kellman & Shevock 6955* (CAS); creek outlet of Taylor Lake, 2 Aug 2020, 6500 ft, *Brooks & Shevock 4083a* (CAS).

Bucklandiella macounii (Kindb.) Bedn.-Ochyra & Ochyra

[*Racomitrium macounii*]

This is a species generally restricted to subalpine areas in California. In the field, it resembles a *Grimmia* Hedw., due to its similar size, but its slightly reddish-brown tufts are distinctive. Sporophytes are rare.

Specimens cited. **RW**: NE slopes above Bingham Lake, 31 Jul 2020, 7250 ft, *Shevock 57125, 57141* and SW slopes above Bingham Lake, 7200 ft, *Shevock 57147*; Pacific Crest Trail just south of Paynes Lake, 1 Aug 2020, 6500 ft, *Shevock & Brooks 57167* and *Brooks & Shevock 4055, 4058, 4061* (CAS); creek

outlet of Taylor Lake, 2 Aug 2020, 6475 ft, *Brooks & Shevock 4071, 4079* (CAS); steep slopes above Statue Lake, 2 Oct 2020, 7300 ft, *Shevock & York 57491, 57493*; slopes above S end of Taylor Lake, 15 Oct 2020, 6650 ft, *Shevock 57649*; E slope of Eaton Lake, 17 Oct 2020, 6625 ft, *Shevock 57746*.

Bucklandiella obesa (Frisvoll) Bedn.-Ochyra & Ochyra

[*Racomitrium obesum*]

This species of *Bucklandiella* Roiv., produces sporophytes abundantly and their setae are characteristically shorter than the other species of this genus.

Specimens cited. **LS**: county road 1C01 at Mill Creek 5 mi SW of Etna, 31 Jul 2020, 3950 ft, *Shevock 57152*; county road 1C02 at Sixmile Creek W of Trail Creek Campground, 27 Oct 2019, 3995 ft, *Shevock & Liu 55469*; South Russian Creek Trail less than 0.5 mi from trailhead, 30 Aug 2020, 4650 ft, *Shevock & Magnaghi 57414*; forest road 41N14, 0.4 mi S of Paynes Lake Trailhead, 18 Oct 2020, 4275 ft, *Shevock 57778*; county road 1C01, 4.7 mi W of Etna Summit paralleling North Russian Creek near confluence with Taylor Creek, 2 Dec 2020, 3490 ft, *Shevock 57920*; **RW**: creek outlet of Taylor Lake, 2 Aug 2020, 6490 ft, *Brooks & Shevock 4075, 4083* (CAS); South Russian Creek Trail at the switchbacks, 3 Oct 2020, 5570 ft, *Shevock & York 57547*; Sugar Creek about 0.5 mi above forest road 41N14, 28 Oct 2020, 4920 ft, *Shevock 57893*.

Bucklandiella occidentalis (Renauld & Cardot) Bedn.-Ochyra & Ochyra

[*Racomitrium occidentale*]

This species is similar, but less common than *B. obesa*. Also, its leaves are narrower and have the upper margins wavy and lumpy.

Specimens cited. **LS**: Paynes Lake Trail near forest road 41N14, 7 Jul 2003, 1450 m, *Norris & Hillyard 105760* (UC); **RW**: Paynes Lake Trail just below crossing of Paynes Lake Creek, 14 Aug 2020, 5600 ft, *Shevock 57266*.

Bucklandiella sudetica (Funck) Bedn.-Ochyra & Ochyra

[*Racomitrium sudeticum*]

This species is closely related to *Bucklandiella macounii*, but is smaller, darker and the capsules are more ovoid in shape.

Specimens cited. **RW**: slopes above Bingham Lake, 31 Jul 2020, 7250 ft, *Shevock 57128a*; Pacific Crest Trail S of junction with trail to Statue Lake, 2 Oct 2020, 6925 ft, *Shevock & York 57500*.

Buxbaumia piperi Best

This moss is exceedingly difficult to find, since it lacks a green leafy gametophyte. So it is only observable when capsules are produced and these are only about a half inch tall. *Buxbaumia piperi* was located at the westernmost portion of the study area, where it was discovered on a rotten *Pseudotsuga* Carrière log in a rather mesic forest along a stream.

Specimen cited. **LS**: county road 1C02 at Shadow Creek, 23 Apr 1984, 900 m, *Norris 70553* (UC).

Campylium stellatum (Hedw.) Lange & C.E.O.Jensen
This moss of wet habitats resembles *Drepanocladus polygamus* (Bruch & Schimp.) Hedenäs, but the leaves are more spreading and lack a costa or it is very short and double.

Specimens cited. **RW**: hillside fen at S end of Taylor Lake, 1 Oct 2020, 6465 ft, *Shevock 57443* and 15 Oct 2020, *Shevock 57638*.

Ceratodon purpureus (Hedw.) Brid.

Ceratodon purpureus is a widespread species, and therefore, it can have several ecological expressions depending on elevation, moisture levels, and amount of direct sunlight. This species prefers gravelly soils and can be common on rocky terraces with a thin layer of soil. Capsules in the study area are apparently quite rare. When capsules are produced, the reddish seta is a helpful diagnostic feature.

Specimens cited. **LS**: Pacific Crest Trail about 3 mi from Etna Summit above Smith Lake, 8 Jul 2003, 2200 m, *Norris & Hillyard 105768* (UC); W side of Upper Ruffey Lake, 16 Oct 2020, 6600 ft, *Shevock 57696*; **RW**: trail to Sugar Lake, 20 Jun 2012, 5800 ft, *Shevock 40384*; outlet of Little Duck Lake, 3 Jul 2020, 6500 ft, *Shevock & Magnaghi 56932* and W side of Little Duck Lake, 3 Jul 2020, 6685 ft, *Shevock & Magnaghi 56952*; steep slope above Statue Lake, 2 Oct 2020, 7200 ft, *Shevock & York 57488*.

Ceratodon stenocarpus Bruch & Schimp.

Ceratodon stenocarpus is generally easily recognized in the field by the present of abundant sporophytes with yellow setae. Slightly disturbed places like road banks are a likely place to encounter this pioneering species. In the study area, it is restricted to lower slopes within mixed conifer forests.

Specimens cited. **LS**: county road 1C01, 4.9 mi W of Etna Summit and 1.8 mi above the North Fork Salmon River Bridge in area lightly burned by a wildfire, 31 Aug 2020, 3550 ft, *Shevock 57158*; county road 1C01, 3.2 mi W of Etna Summit just below Jumpoff Joe Curve, 2 Dec 2020, 4125 ft, *Shevock 57904*.

Claopodium bolanderi Best

This species is rather large and conspicuous and generally occurs on boulders with some litter. In the study area, it is most frequently encountered along stream banks. The usually dull, dark green plants may be rust-colored in exposed sites.

Specimens cited. **LS**: forest road 41N16 at crossing of Little Jackson Creek, 1.2 mi from county road 1C02, 30 Jun 2020, 5200 ft, *Shevock 57108*; forest road 41N16 toward Jackson Lake, 3.4 mi from junction with county road 1C02, 30 Jul 2020, 5780 ft, *Shevock 57120*; forest road 41N14 at French Creek, 2 mi N of Sugar Creek Trailhead, 13 Aug 2020, 4195 ft, *Shevock 57230*; below crossing of forest road 39N06 along Trail Creek, 26 Oct 2020, 4850 ft, *Shevock 57813*; **RW**: Sugar Creek just below Sugar

Lake, 20 Jun 2012, 5935 ft, *Shevock* 40391, 40399; between Albert Lake and Upper Albert Lake, 1 Aug 2020, 6900 ft, *Shevock & Brooks* 57186; S end of Taylor Lake, 1 Oct 2020, 6465 ft, *Shevock* 57460; South Russian Creek Trail between wilderness boundary and switchbacks, 3 Oct 2020, 5300 ft, *Shevock & York* 57523; Sugar Creek about 0.5 mi above forest road 41N14, 28 Oct 2020, 4840 ft, *Shevock* 57883.

Claopodium whippleanum (Sull.) Renauld & Cardot
Found only at the lower elevations of the study area and lacking sporophytes, this moss in thin, dullish yellow green mats usually occurs on bare soil. The serrate leaves have strongly unipapillose cells.

Specimens cited. **LS**: county road 1C01, 3.2 mi W of Etna Summit just below Jumpoff Joe Curve, 2 Dec 2020, 4125 ft, *Shevock* 57903, 57912.

Codriophorus acicularis (Hedw.) P.Beauv.

[*Racomitrium aciculare*]

This is the most common rheophytic species throughout the study area on both granitic and metamorphic rocks along rivulets, streamlets, and creeks. Plants with sporophytes appear to be rare to uncommon in the study area. Plants are either seasonally submerged during snowmelt or in the splash zone. They can also become jet-black when dry in exposed situations. For excellent illustrations of all *Codriophorus* P.Beauv., species in California, see Bednarek-Ochyra (2006).

Specimens cited: **LS**: county road 1C01, 3.8 mi E. of Etna Summit, 21 Jun 2020, 4300 ft, *Shevock* 56912; Russian Creek at forest road 40N54 just S of county road 1C01, 21 Jun 2020, 2695 ft, *Shevock* 56900; county road 1C01 at Mill Creek, 5 mi SW of Etna, 27 Aug 2020, 3950 ft, *Shevock* 57319; along the Pacific Crest Trail N of Carter Meadows Summit, 15 Aug 2020, 6975 ft, *Shevock* 57282; trail between Deacon Lee Trailhead and Waterdog Lake, 29 Aug 2020, 6540 ft, *Shevock & Magnaghi* 57390; South Russian Creek about 1 mi from trailhead, 30 Aug 2020, 4690 ft, *Shevock & Magnaghi* 57419; forest road 41N14, 0.3 mi S of Duck Lake Trailhead, 18 Oct 2020, 4300 ft, *Shevock* 57781; **RW**: Sugar Creek just below outlet of Sugar Lake, 20 Jun 2012, 5935 ft, *Shevock* 40390, 40396; Sugar Creek about 0.5 mi below Sugar Lake, 6 Oct 2012, 5850 ft, *Shevock & Kellman* 41158 and *Kellman & Shevock* 6916, 6934 (CAS); S side of Little Duck Lake, 3 Jul 2020, 6600 ft, *Shevock & Magnaghi* 56950, lake outlet of Little Duck Lake, 3 Jul 2020, 6550 ft, *Shevock & Magnaghi* 56930, and between Big Duck Lake and Little Duck Lake, 6500 ft, *Shevock & Magnaghi* 56961; streamlet below the outlet of Bingham Lake, 31 Jul 2020, 7000 ft, *Shevock* 57142; slopes above E side of Bingham Lake, 31 Jul 2020, 7050 ft, *Shevock* 57134; between Albert Lake and Upper Albert Lake, 1 Aug 2020, 6900 ft, *Shevock & Brooks* 57180, *Brooks & Shevock* 4067, 4068 (CAS) and 14 Aug 2020, 7095 ft, *Shevock* 57255; S side of Upper Albert Lake, 1 Aug 2020, *Brooks & Shevock* 4063, 4064 (CAS); below the outlet

of Taylor Lake, 2 Aug 2020, 6400 ft, *Shevock & Brooks* 57194 and *Brooks & Shevock* 4072 (CAS); Albert Lake, 1 Aug 2020, *Brooks & Shevock* 4059 (CAS); S side of Hogan Lake, 28 Aug 2020, 5960 ft, *Shevock & Magnaghi* 57383; outlet at N side of Russian Lake, 29 Aug 2020, 7020 ft, *Shevock & Magnaghi* 57404; Pacific Crest Trail at trail junction to Statue Lake, 2 Oct 2020, 6925 ft, *Shevock & York* 57476; South Russian Creek Trail between wilderness boundary and switchbacks, 3 Oct 2020, 5300 ft, *Shevock & York* 57527; S end of Eaton Lake, 17 Oct 2020, 6625 ft, *Shevock* 57749; Duck Lake Creek at junction with Eaton Lake Trail, 17 Oct 2020, 5675 ft, *Shevock* 57754, 57758.

Codriophorus depressus (Lesq.) Bedn.-Ochyra & Ochyra

[*Racomitrium depressum*]

This species often grows with *Codriophorus acicularis* and *Schistidium rivulare* (Brid.) Podp. The dry plants differ from the former in having non-julaceous shoots.

Specimens cited. **RW**: Paynes Lake Trail just above crossing of Paynes Lake Creek, 14 Aug 2020, 6000 ft, *Shevock* 57240; South Russian Creek Trail above the switchbacks, 3 Oct 2020, 5600 ft, *Shevock & York* 57549.

Codriophorus mollis (Cardot) Bedn.-Ochyra & Ochyra

[*Racomitrium molle*]

This species is evidently very rare in California. It is known only from the Marble Mountain Wilderness and the Russian Wilderness. Only three collections are cited in Norris and Shevock (2004a) and the same collections examined are cited in the *Codriophorus* monograph by Bednarek-Ochyra (2006). Compared with *Codriophorus acicularis*, this moss has shorter leaves with a more broadly rounded apex and shorter costa.

Specimens cited: **RW**: Big Duck Lake, 13 Oct 1972, 6600 ft, *Norris* 23340 (UC); Paynes Lake, 2 Aug 1975, 6000 ft, *Norris & Smith* 46334 (UC).

Conardia compacta (Müll.Hal.) H.Rob.

This moss bears a resemblance to *Amblystegium serpens*, but is separated by longer and narrower leaf cells, a longer costa and papillose rather than smooth rhizoids. This species was found only at one locality in the study area.

Specimens cited. **LS**: Jackson Creek above county road 1C02, 23 Apr 1984, 1500 m, *Norris* 70499, 70503, 70505, 70531 (UC) and 26 Oct 2020, 4500 ft, *Shevock* 57786.

Cratoneuron filicinum (Hedw.) Spruce

This moss which inhabits various wet sites is remarkably plastic with regard to growth habit, branching pattern, leaf shape, and alar cell development. In California, it is more frequently encountered in areas with calcareous water.

Specimens cited. **LS**: Upper Ruffey Lake, 22 Jul 2006, 6615 ft, *Lenz* 3101 (CAS); **RW**: S end of Taylor

Lake, 4 Jul 2006, 6500 ft, *Lenz 3048* (CAS) and 1 Oct 2020, *Shevock 57458*.

Cynodontium jenneri (Schimp.) Stirt.

This species was reported for California in Norris and Shevock (2004a) from a single collection, however, that sterile specimen later proved to be misidentified. This specimen from the Russian Wilderness has sporophytes and the species is now confirmed for the state.

Specimen cited. **RW**: W side of Little Duck Lake, 3 Jul 2020, 6685 ft, *Shevock & Magnaghi 56956*.

Dannorrisia bigelovii (Sull.) Enroth

[*Porotrichum bigelovii*]

The monospecific genus *Dannorrisia* Enroth was established in 2019 (Enroth et al. 2019) to accommodate this Pacific slope endemic. The genus *Porotrichum* (Brid.) Hampe based on molecular data was determined to be highly polyphyletic and the newly established segregate genera are now placed within two families. See Enroth et al. (2019) for more discussion. *Dannorrisia* is widespread in northern California and is best developed along riparian corridors in more mesic forests closer to the coast. The populations in the study area represent plants that are approaching its easternmost outpost in the Klamath Ranges.

Specimens cited. **LS**: county road C101 at Mill Creek, 5 mi SW of Etna, 27 Aug 2020, 3950 ft, *Shevock 57322*; forest road 41N14 at Wildcat Creek, 28 Oct 2020, 4960 ft, *Shevock 57899*; **RW**: along Sugar Creek just above wilderness boundary, 28 Oct 2020, 4950 ft, *Shevock 57886*.

Dendroalsia abietina (Hook.) E.Britton ex Broth.

This is perhaps the most distinctive large moss in California that can form massive colonies especially on tree trunks below areas with a prolonged snowpack. This species can also colonize boulders generally at the higher elevations of its range. When hydrated, the plants resemble a conifer tree due to the upright and rigid stipe, but when dry the branches fold inward and curl up like a fern frond.

Specimens cited. **LS**: county road 1C02 at Sixmile Creek, 27 Oct 2019, 3995 ft, *Shevock & Liu 55471*; county road 1C02 at Shadow Creek, 21 Jun 2020, 3310 ft, *Shevock 56885*; forest road 40N54 at Russian Creek just off of county road C101, 2 Aug 2020, 2580 ft, *Shevock & Brooks 57190*; forest highway 39, 0.6 mi from junction with county road 1C02, 27 Oct 2020, 4130 ft, *Shevock 57860*; county road 1C01, 4.7 mi W of Etna Summit paralleling North Fork Russian Creek near confluence with Taylor Creek, 2 Dec 2020, 3490 ft, *Shevock 57918*.

Dichodontium flavescens (Dicks.) Kindb.

This species is infrequently encountered in the project area. It generally prefers permanently wet areas, such as springs and seeps in shaded environments. Mature sporophytes are rare.

Specimens cited. **LS**: forest road 40N54, 0.2 mi below South Russian Creek Bridge at hillside seep and

spring, 30 Aug 2020, 4100 ft, *Shevock 57432*; Mill Creek, county road 1C01, 5 mi SW of Etna, 15 Oct 2020, 3950 ft, *Shevock 57625*; forest road 41N14, 0.1 mi S of Paynes Lake Trailhead, 18 Oct 2020, 4350 ft, *Shevock 57771*; Jackson Creek above county road 1C02, 26 Oct 2020, 4500 ft, *Shevock 57792*; forest highway 39, 2 mi from junction with county road 1C02, 27 Oct 2020, 5920 ft, *Shevock 57850* and 1.1 mi from 1C02, 4530 ft, *Shevock 57854*; **RW**: streamlets flowing into Sugar Creek, 6 Oct 2012, 5975 ft, *Shevock & Kellman 41169*; South Russian Creek Trail between wilderness boundary and switchbacks, 3 Oct 2020, 5300 ft, *Shevock & York 57537* and 5700 ft, *Shevock & York 57550*. Sugar Creek about 0.6 mi from forest road 41N14, 28 Oct 2020, 4920 ft, *Shevock 57885, 57887, 57888*.

Dichodontium pellucidum (Hedw.) Schimp.

This is a fairly common moss of rheophytic habitats. It differs at a glance from *Dichodontium flavescens* by its more robust stature and less linear leaves.

Specimens cited. **LS**: forest road 40N54 just S of junction with county road 1C01, Russian Creek, 21 Jun 2020, 2695 ft, *Shevock 56901*; forest road 41N14 at Horse Range Creek, 0.8 mi S of Paynes Lake Trailhead, 14 Aug 2020, 4490 ft, *Shevock 57271*; county road 1C01 at Taylor Creek just above confluence with North Russian Creek, 27 Aug 2020, 3570 ft, *Shevock 57342*; county road 1C01, 1 mi W of Etna Summit, 21 Jun 2020, 5325 ft, *Shevock 56910*; county road 1C01 at Mill Creek 5 mi SW of Etna, 27 Aug 2020, 3950 ft, *Shevock 57313, 57321, 57325*; **RW**: trail to Taylor Lake just below lake outlet, 2 Aug 2020, 6400 ft, *Shevock & Brooks 57210*.

Dicranella rufescens (With.) Schimp.

This species was found only once in the study area and the population is entirely of male plants. In a sterile condition and when growing on sunny moist soil in fens, this plant can resemble *Bruchia bolanderi* Lesq. A good microscopic character for *D. rufescens* is the marginal cells at the leaf apex are larger than the laminal ones.

Specimen cited. **LS**: fen at Meeks Meadow Lake, 16 Oct 2020, 6200 ft, *Shevock 57709*.

Dicranoweisia cirrata (Hedw.) Lindb. ex Milde

This is generally a widespread and common species on the base of conifer trunks, rotten logs, and charred wood. It is usually associated with *Aulacomnium androgynum* and *Orthodicranum tauricum* as common associates in mixed conifer forests. With recent fires in the lower slopes of the Salmon Mountains, we expected to find this moss more often. One occurrence here in the study area appears to be near its elevational limit.

Specimens cited. **LS**: South Russian Creek Trail less than 0.5 mi from the trailhead at end of forest road 40N54A, 30 Aug 2020, 4650 ft, *Shevock & Magnaghi 57429*; Shadow Creek off county road 1C02, 27 Oct 2020, 3270 ft, *Shevock 67829*; county road 1C01, 4.7 mi W of Etna Summit paralleling North Fork

Russian Creek near confluence with Taylor Creek, 2 Dec 2020, 3490 ft, *Shevock 57919*.

***Dicranum fuscescens* Turner**

When dry, this species has leaves that are darker green and crisped than the two following *Dicranum* Hedw., species. The upper leaf cells are quadrate.

Specimens cited. **RW**: slopes above Sugar Lake, 25 Jul 1980, 6600 ft, *Norris 57314* (UC); S side of Little Duck Lake, 3 Jul 2020, 6550 ft, *Shevock & Magnaghi 56939*; slopes immediately below Russian Lake outlet, 29 Aug 2020, 7020 ft, *Shevock & Magnaghi 57403*.

***Dicranum howellii* Renauld & Cardot**

This moss is usually more yellow-green in color and forms more robust colonies compared with *Dicranum fuscescens*. Its upper leaf cells are rectangular. In addition, it prefers boulders with some needle litter. Specimens cited. **LS**: county road C101, 4.9 mi SW of Etna Summit and 1.8 mi from North Fork Salmon River Bridge, 31 Jul 2020, 3590 ft, *Shevock 57157* and at Taylor Creek just above the confluence with North Russian Creek, 27 Aug 2020, 3570 ft, *Shevock 57338*; Sixmile Creek above county road 1C02, 26 Oct 2020, 4025 ft, *Shevock 57827*; forest road 40N61, 0.1 mi from junction with county road 1C01 and North Fork Salmon River, 25 Mar 2021, 2300 ft, *Shevock 58161*.

***Dicranum scoparium* Hedw.**

This species is quite similar to *D. howellii*, only differentiated by perichaetial leaf morphology.

Specimen cited. **LS**: county road 1C02 at Shadow Creek, 21 Jun 2020, 3310 ft, *Shevock 56886*.

***Didymodon eckeliae* R.H.Zander**

Plants of *Didymodon eckeliae* tend to have the upper parts green, quickly becoming bright orange below. The leaves are mostly abruptly linear-lanceolate and strongly contorted when dry. Microscopically, diagnostic features are its irregularly notched or scalloped bistratose leaf margins.

Specimens cited. **LS**: Russian Creek below bridge crossing of forest road 40N54, 16 Oct 2020, 2580 ft, *Shevock 57667*; forest road 40N54, 1 mi from junction with county road 1C01, 25 Mar 2021, 2990 ft, *Shevock 58156*.

***Didymodon insulanus* (DeNot.) M.O.Hill**

This species often occurs in sandy pockets among streamside rocks where it is either seasonally submerged or inundated.

Specimens cited. **LS**: forest road 41N14 near Duck Lakes Trailhead, 11 Jun 1972, 5500 ft, *Norris 22866* (UC); end of logging spur road off of county road 1C02 just below Carter Meadows Summit, Little Jackson Creek, 13 Jun 2020, 5575 ft, *Shevock 56773*; county road 1C01, 3.8 mi eastward from Etna Summit and W of Mill Creek, 21 Jun 2020, 4300 ft, *Shevock 56914* and at Mill Creek 5 mi SW of Etna, 27 Aug 2020, 3950 ft, *Shevock 57320*; forest road 40N54 at Russian Creek Bridge, 27 Aug 2020, 2580 ft,

Shevock 57348; forest road 41N14, 0.4 mi S of Paynes Lake Trailhead, 18 Oct 2020, 4275 ft, *Shevock 57776*; North Fork Salmon River off of county road 1C01, 2.2 mi SW of Idlewild Campground, 2 Dec 2020, 2550 ft, *Shevock 57949*; confluence of North Russian and South Russian Creeks, 25 Feb 2021, 2665 ft, *Shevock 57984*.

***Didymodon nicholsonii* Culm.**

This moss usually occurs on rocks near streams. It is usually very dark in color and has relatively blunt leaf apices with bistratose regions.

Specimens cited. **LS**: county road 1C01, 2 mi W of Etna Summit, 27 Aug 2020, 4930 ft, *Shevock 57327*; North Fork Salmon River above forest road 40N61, 4 Oct 2020, 2380 ft, *Shevock 57604*.

***Didymodon tophaceus* (Brid.) Lisa**

This *Didymodon* appears to be rare in the study area, documented by only one depauperate specimen. The rounded leaf apices and decurrent leaf bases are just two of its diagnostic features.

Specimen cited. **LS**: county road 1C02 at Sixmile Creek, 26 Oct 2020, 4025 ft, *Shevock 57820*.

***Didymodon vinealis* (Brid.) R.H.Zander**

This species is quite variable and grows on soil and rock and usually has a reddish cast. The mostly ovate-lanceolate leaves are contorted when dry. Although it is evidently rare in the study area, it is common and widespread in California.

Specimens cited. **LS**: along county road 1C01, 2.8 mi W of Etna Summit and just above Jumpoff Joe Curve, 2 Dec 2020, 4340 ft, *Shevock 57901*; and 3.2 mi, 2 Dec 2020, 4125 ft, *Shevock 57908*; county road 1C01, 0.5 mi W of forest road 41N22 and Cow Creek, 2 Dec 2020, 3150 ft, *Shevock 57944*; county road 1C01, 1.5 mi W of North Fork Salmon River Bridge from Idlewild Campground, 25 Feb 2021, 2500 ft, *Shevock 57998*.

***Ditrichum ambiguum* Best**

This is a rather nondescript moss, especially when sterile. It forms short to medium tufts on bare soil banks and is often mixed with other mosses. Microscopically, the lanceolate to linear-lanceolate leaves have margins that are recurved and bistratose above and are more or less serrulate at the apex.

Specimen cited. **LS**: county road 1C01, 3.2 mi W of Etna Summit just below Jumpoff Joe Curve, 2 Dec 2020, 4125 ft, *Shevock 57910*.

***Drepanocladus polygamus* (Bruch & Schimp.) Hedenäs**

This species, uncommon in the Russian Wilderness area, might be confused with *Campylium stellatum*, but its costa is single and longer.

Specimens cited. **LS**: Upper Ruffey Lake, 22 Jul 2006, 6615 ft, *Lenz 3099* (CAS) and 16 Oct 2020, *Shevock 57676*, *57681*; **RW**: margin of Sugar Lake, 6 Oct 2012, 5960 ft, *Shevock & Kellman 41161*; E shore of Eaton Lake, 17 Oct 2020, 6625 ft, *Shevock 57739*.

Dryptodon patens (Dicks. ex Hedw.) Brid.

[*Grimmia ramondii*]

This is a widespread moss on boulders throughout the study area, especially within mixed conifer forests. In drier sites, the plants can be much reduced in size. The genus *Dryptodon* Brid., is an earlier name to accommodate a suite of rather large mosses that traditionally are placed within the circumscription of the genus *Grimmia*. This species was also viewed historically as a member of the genus *Racomitrium* Brid. The winged costa and ribbed capsules on an arcuate seta are characters that can be observed with a hand-lens, making it easy to identify in the field.

Specimens cited. **LS**: forest road 41N16 at crossing of Little Jackson Creek, 1.2 mi from the junction with county road 1C02, 30 Jul 2020, 5200 ft, *Shevock 57107*; South Russian Creek Trail about 1 mi from the trailhead, 30 Aug 2020, 4690 ft, *Shevock & Magnaghi 57426*; **RW**: S side of Sugar Lake, 20 Jun 2012, 5950 ft, *Shevock 40410*; trail to Big and Little Duck Lakes, 3 Jul 2020, 5780 ft, *Shevock & Magnaghi 56980*, above trail junction from Duck Lake toward Little Duck Lake, 3 Jul 2020, 6500 ft, *Shevock & Magnaghi 56962* and W side of Little Duck Lake, *Shevock & Magnaghi 56951*; E side of Bingham Lake, 31 Jul 2020, 7145 ft, *Shevock 57138*; Pacific Crest Trail S of Paynes Lake, 1 Aug 2020, 6565 ft, *Brooks & Shevock 4052, 4053 (CAS)*; Paynes Lake Trail about 0.5 mi from junction with the Pacific Crest Trail, 14 Aug 2020, 6000 ft, *Shevock 57244*; E slope of Eaton Lake, 17 Oct 2020, 6625 ft, *Shevock 57747*; Sugar Creek about 0.5 mi above forest road 41N14, 28 Oct 2020, 5840 ft, *Shevock 57874*.

Encalypta rhaptocarpa Schwägr.

This species generally occurs on soil over rock in small clumps among other mosses. It differs by its hairpointed versus muticous leaves, as well as its more strongly furrowed capsules.

Specimens cited. **LS**: county road 1C01, 0.9 mi NE of junction with forest road 40N61; about 1.5 mi SW of Idlewild Campground and bridge crossing of North Fork Salmon River, 2 Dec 2020, 2550 ft, *Shevock 57958* and 25 Feb 2021, 2500 ft, *Shevock 57999*; North Fork Salmon River paralleling county road 1C01, 1.8 mi W of Idlewild Campground, 25 Feb 2021, 2480 ft, *Shevock 58003*.

Encalypta vulgaris Hedw.

Although similar in size to *Encalypta rhaptocarpa*, *E. vulgaris* can be readily distinguished by the absence of a leaf hair point. The preferred habitat of both is thin soil over sunny rock.

Specimen cited. **LS**: county road 1C01 at road marker 22, 0.5 mi below North Russian Creek bridge, 25 Mar 2021, 2775 ft, *Shevock 58151*.

Eurhynchiastrum pulchellum (Hedw.) Ignatov & Huttunen

[*Eurhynchium pulchellum*]

This species can be recognized by the blunt, uniquely incurved branch leaves not clasping the stem when dry.

Specimens cited. **LS**: county road 1C01 at spring 3.4 mi W of Etna Summit just below Jumpoff Joe Curve, 27 Aug 2020, 4115 ft, *Shevock 57332*; hillside spring along county road 1C01, 0.3 mi E of Etna Summit, 1 Oct 2020, 5940 ft, *Shevock 57442*; below outlet of Upper Ruffey Lake, 16 Oct 2020, 6550 ft, *Shevock 57686, 57688*; forest road 41N14, 0.1 mi S of Paynes Lake Trailhead, 18 Oct 2020, 4350 ft, *Shevock 57766*; forest road 39N06 at crossing of Trail Creek, 26 Oct 2020, 4850 ft, *Shevock 57802*; **RW**: slopes near South Sugar Lake, 31 Aug 1974, 6000 ft, *Norris & McGrew 45632 (UC)*; slopes above Sugar Lake, 6 Oct 2012, 5975 ft, *Shevock & Kellman 41162*; trail to Little Duck Lake above junction to Big Duck Lake, 3 Jul 2020, 6500 ft, *Shevock & Magnaghi 56967*; trail between Taylor Lake and Hogan Lake, 28 Aug 2020, 6030 ft, *Shevock & Magnaghi 57358*; steep slopes above Statue Lake, 2 Oct 2020, 7300 ft, *Shevock & York 57492*; slopes above S end of Taylor Lake, 15 Oct 2020, 6650 ft, *Shevock 57658*.

Fabronia pusilla Raddi

This is one of California's smallest pleurocarpous mosses, most often found on the bark of living trees, but in the project area was found once on rock crevices of metamorphic boulders. The leaf margins are ciliate-dentate and the apices end in a long, needle-like cell. Its tiny capsules were present in this collection.

Specimen cited. **LS**: county road 1C01 at junction with forest road 40N61 above the North Fork Salmon River, 25 Feb 2021, 2470 ft, *Shevock 57973*.

Fissidens aphelotaxifolius Pursell

This species is among the rarest mosses documented for California. Described nearly 50 years ago (Pursell 1976), it is apparently very rare throughout its range, which extends from British Columbia to California. The first California collection of this species was obtained by Karen McGrew in 1973 as part of her master's project (McGrew 1976). It was known for California only from this single specimen until it was subsequently located on the Sierra National Forest, Madera County in 2012. *Fissidens aphelotaxifolius* is a rheophytic species, and due to its slightly larger size compared with many *Fissidens* species occurring in California, it is rather surprising that it has not been encountered elsewhere. Many streamlets originating from lake outlets in the Russian Wilderness during this study have been surveyed, but *Fissidens aphe-*
lotaxifolius was not encountered.

Specimen cited. **RW**: outflow of Lower Russian Lake in moist granitic crevice, 8 Sep 1973, 6400 ft, *McGrew 0322 (UC)*.

Fissidens bryoides Hedw.

California plants of this extremely variable species are usually found in wetter places than the similar

Fissidens crispus Mont. It is slightly more robust than the latter species, as well as having less contorted leaves when dry.

Specimen cited. **LS**: dripping vertical wall of Cow Creek just above county road 1C01 at junction with forest road 40N22, 2 Dec 2020, 3260 ft, *Shevock* 57937.

Fissidens crispus Mont.

Although this is a widespread species frequently with capsules occurring on soil throughout cismontane California, it is rare in the study area being restricted to the lowest elevations.

Specimens cited. **LS**: county road 1C02, banks of Shadow Creek, 13 Jun 2020, 2870 ft, *Shevock* 56789; Cow Creek just above county road 1C01 at junction with forest road 40N22, 2 Dec 2020, 3260 ft, *Shevock* 57935; forest road 40N61, 0.1 mi from junction with county road 1C01 and North Fork Salmon River, 25 Mar 2021, 2380 ft, *Shevock* 58160.

Fissidens grandifrons Brid.

This species is easy to recognize due to its rather thickened stiff deep green leaves, which most often are encrusted with lime. Plants are found in perennially wet sites, such as dripping springs or on rocks with running calcareous water.

Specimen cited. **LS**: county road 1C01 at spring 3.4 mi W of Etna Summit just below Jumpoff Joe Curve, 31 Jul 2020, 4100 ft, *Shevock* 57156.

Fissidens ventricosus Lesq.

This is a rheophytic species that is usually submerged in streams and rivers until late summer, when it is then either in the splash zone or on moist boulders. In the study area, *Darmera peltata* is frequently associated with this Pacific slope endemic.

Specimens cited. **LS**: county road 1C02 at Sixmile Creek, 27 Oct 2019, 3995 ft, *Shevock & Liu* 55468; forest road 41N14 at French Creek, 7 mi N of county road 1C02 and 2 mi N of the Sugar Lake Trailhead, 14 Aug 2020, 4195 ft, *Shevock* 57276; county road 1C01 along North Fork Russian Creek, 2 mi from the North Fork Salmon River Bridge, 16 Aug 2020, 3035 ft, *Shevock* 57303; North Fork Salmon River above junction with forest road 40N61, 4 Oct 2020, 2380 ft, *Shevock* 57610; Whites Gulch Creek just below junction with Whites Gulch Trail along forest road 40N61, 4 Oct 2020, 2775 ft, *Shevock* 57616; Trail Creek below crossing of forest road 39N06, 26 Oct 2020, 4850 ft, *Shevock* 57814.

Fontinalis antipyretica Hedw.

Although this is the most common species of *Fontinalis* Hedw., in California, it is less common in the Russian Wilderness area than the following species listed below.

Specimens cited. **LS**: S end of Upper Ruffey Lake, 16 Oct 2020, 6600 ft, *Shevock* 57677; **RW**: South Sugar Lake, 30 Sep 1973, 6900 ft, *McGrew* 0614 (UC); Sugar Creek just below outlet of Sugar Lake, 20 Jun 2012, 5935 ft, *Shevock* 40388.

Fontinalis chrysophylla Cardot

The plants of *F. chrysophylla* are very dark in color and the leaves are densely set on the stems.

Specimens cited. **RW**: Taylor Lake, 19 Aug 1994, 1950 m, *Norris* 83432 (UC); near outlet at Sugar Lake, 6 Oct 2012, 1810 m, *Kellman & Shevock* 6917 (CAS); below outlet of Taylor Lake, 2 Aug 2020, 6400 ft, *Shevock & Brooks* 57199; NE side of Paynes Lake just above the Pacific Crest Trail, 14 Aug 2020, 6500 ft, *Shevock* 57250; between Taylor Lake and Hogan Lake, 28 Aug 2020, 6030 ft, *Shevock & Magnaghi* 57362; lake outlet of Hogan Lake, 28 Aug 2020, 5935 ft, *Shevock & Magnaghi* 57373; outlet of Waterdog Lake, 29 Aug 2020, 7000 ft, *Shevock & Magnaghi* 57395; South Russian Creek Trail between wilderness boundary and switchbacks, 3 Oct 2020, 5300 ft, *Shevock & York* 57522.

Fontinalis howellii Renauld & Cardot

This species has strongly dimorphic leaves.

Specimens cited. **RW**: S side of Little Duck Lake in streamlet, 3 Jul 2020, 6600 ft, *Shevock & Magnaghi* 56947; E shore of Bingham Lake, 31 Jul 2020, 7050 ft, *Shevock* 57137; between Albert Lake and Upper Albert Lake, 1 Aug 2020, 6900 ft, *Shevock & Brooks* 57181; Albert Lake, 1 Aug 2020, 6930 ft, *Brooks & Shevock* 4057 (CAS); Eaton Lake, 17 Oct 2020, 6625 ft, *Shevock* 57737.

Fontinalis neomexicana Sull. & Lesq.

This is a much more slender and deep green colored plant than *F. antipyretica*. It has long attenuate stem and branch apices. Sporophytes are infrequently encountered.

Specimens cited. **LS**: county road 1C02 at Shadow Creek, 13 Jun 2020, 2870 ft, *Shevock* 56793; Meeks Meadow Creek below Meeks Meadow Lake, 16 Oct 2020, 6185 ft, *Shevock* 57712; forest road 41N14, 0.3 mi S of Duck Lake Trailhead, 18 Oct 2020, 4300 ft, *Shevock* 57783; Trail Creek above crossing of forest road 39N06, 25 Oct 2020, 4850 ft, *Shevock* 57811; county road 1C01, 4.7 mi W of Etna Summit paralleling North Fork Russian Creek near confluence with Taylor Creek, 2 Dec 2020, 3490 ft, *Shevock* 57927; **RW**: Duck Lake Creek, 13 Oct 1972, 5500 ft, *Norris* 23298 (US); outlet of Russian Lake, 29 Aug 2020, 7020 ft, *Shevock & Magnaghi* 57410.

Frisvollia varia (Mitt.) Sawicki, Szczecińska, Bedn.-Ochyra & Ochyra

[*Racomitrium varium*; as *Codriophorus varius* in Bednarek-Ochyra (2006)]

This is a large and showy species that prefers to occupy boulders above the high water zone of streams and rivers. Plants have a yellowish-green cast. Sporophytes have a tall seta and exceptionally long peristome teeth. For detailed illustrations, see Bednarek-Ochyra (2006) as *Codriophorus varius* (Mitt.) Bedn.-Ochyra & Ochyra.

Specimens cited. **LS**: forest road 40N54 above Russian Creek Bridge just off of junction with county road 1C01, 21 Jun 2020, 2695 ft, *Shevock*

56902; county road 1C01 at North Russian Creek Bridge, 16 Aug 2020, 3035 ft, *Shevock* 57291; forest road 41N14, 0.1 mi S of Paynes Lake Trailhead, 18 Oct 2020, 4350 ft, *Shevock* 57772; Trail Creek above crossing of forest road 39N06, 26 Oct 2020, 4850 ft, *Shevock* 57807.

Funaria hygrometrica Hedw.

This is a widespread species, although populations are usually rather short lived. Populations can appear soon after wildfires or prescribed burns, then decrease in abundance in subsequent years. The forest floor can turn orange with mature sporophytes the first few years after soil has been charred.

Specimen cited: **LS**: along forest road 40N54 at Russian Creek, 27 Aug 2020, 2580 ft, *Shevock* 57346.

Gemmabryum barnesii (J.H.Wood ex Schimp.) J.R.Spence

[*Bryum barnesii*]

This species grows in loose tufts less than one centimeter tall and often inhabits sunny compacted or gravelly soils. This specimen was bearing bulbils, 2–3 in each leaf axil. No sporophytes were present.

Specimen cited. **LS**: county road 1C01, 1.5 mi W of North Fork Salmon River Bridge from Idlewild Campground, 25 Feb 2021, 2500 ft, *Shevock* 57992.

Gemmabryum caespiticium (Hedw.) J.R.Spence

[*Bryum caespiticium*]

These plants grow in short dense tufts and individual shoots have comose foliation. The costa is long excurrent to a smooth or slightly toothed awn and the apical leaf cells become suddenly longer than those below.

Specimens cited. **LS**: Paynes Creek at forest road 41N14, 2 Aug 1975, *Norris & Smith* 46317 (UC); **RW**: outlet of Waterdog Lake, 8 Sep 1973, 6900 ft, *McGrew* 0246 (UC); slopes above S end of Taylor Lake, 15 Oct 2020, 6650 ft, *Shevock* 57647a.

Gemmabryum dichotomum (Hedw.) J.R.Spence & H.P.Ramsay

[*Bryum dichotomum*]

This species usually grows on bare soil and the local plants are with sporophytes. The bulbils are usually borne singly in the leaf axils. Its short, ovoid capsules with wrinkled neck make identification more certain.

Specimen cited. **LS**: North Fork Salmon River paralleling county road 1C01, 1.8 mi W of Idlewild Campground, 25 Feb 2021, 2480 ft, *Shevock* 58005.

Gemmabryum vinosum J.R.Spence & Kellman

This moss, although fairly widespread in California, was not described until 2015 (Spence and Kellman 2015). When well developed it forms dense, spreading tufts which by early summer have green and crimson variegation.

Specimens cited. **LS**: county road 1C01, 0.9 mi NE of junction with forest road 40N61 and about 1.5 mi SW of Idlewild Campground and bridge crossing of North Fork Salmon River, 2 Dec 2020, 2550 ft, *Shevock*

57959; at junction of forest road 40N61 at county road 1C01, 25 Feb 2021, 2470 ft, *Shevock* 57974.

Grimmia alpestris (F.Weber & D.Mohr) Schleich.

This is a fairly widespread species occurring on boulders and rock walls within coniferous forests in California. In the field, it greatly resembles *Grimmia montana* Bruch & Schimp., and the two may grow sympatrically. Microscope examination of the basal cells is necessary to separate sterile plants of *G. alpestris* from *G. montana*. The former has quadrate cells and the latter has rectangular cells.

Specimens cited: **LS**: forest road 41N14 at Paynes Creek, 2 Aug 1975, *Norris & Smith* 46312, 46316 (UC); Pacific Crest Trail S of Etna Summit above Smith Lake, 8 Jul 2003, 2200 m, *Norris & Hillyard* 105774, 105778 (UC); Pacific Crest Trail N of Carter Meadows Summit, 15 Aug 2020, 7080 ft, *Shevock* 57277; trail between Deacon Lee Trailhead and Waterdog Lake, 29 Aug 2020, 6900 ft, *Shevock & Magnaghi* 57393; forest highway 39, 0.7 mi E of junction with forest road 39N58, 27 Oct 2020, 6025 ft, *Shevock* 57849; **RW**: Sugar Lake, 25 Aug 1973, 5900 ft, *McGrew* 0130 (UC); South Sugar Lake, 31 Aug 1974, 6000 ft, *Norris & McGrew* 45635 (UC); Taylor Lake, 4 Jul 2006, 6500 ft, *Lenz* 3051 (CAS); Pacific Crest Trail S of trail junction to Statue Lake, 2 Oct 2020, 6950 ft, *Shevock & York* 57506; E shore of Eaton Lake, 17 Oct 2020, 6625 ft, *Shevock* 57741.

Grimmia anomala Hampe ex Schimp.

Globular, multicellular gemmae often occur on the leaf apices. Also, the upper leaf cells are covered by longitudinal ridges. Sporophytes are unknown from the study area.

Specimens cited. **LS**: W side of Upper Ruffey Lake, 16 Oct 2020, 6600 ft, *Shevock* 57699; Meeks Meadow Creek above Meeks Meadow Lake, 16 Oct 2020, 6225 ft, *Shevock* 57718; **RW**: trail between Taylor Lake and Hogan Lake, 28 Aug 2020, 6050 ft, *Shevock & Magnaghi* 57366; slope above S end of Taylor Lake, 15 Oct 2020, 6650 ft, *Shevock* 57642.

Grimmia brevirostris R.S.Williams

In Norris and Shevock (2004a), this species was viewed as a synonym of *Grimmia hamulosa* Lesq., based on the treatment by Muñoz and Pando (2000). However, after developing the *Grimmia* treatment for the *Flora of North America North of Mexico* by Roxanne Hastings and Henk Greven (Flora of North America Editorial Committee 2007), a concern was raised about the proposed synonymy of *Grimmia brevirostris* within *G. hamulosa* based on the original description. A search at the type locality on the Plumas National Forest, Plumas County, California was conducted during the summer of 2013 (Dillingham 2015) and *Grimmia brevirostris* was rediscovered near the type locality growing among *Grimmia hamulosa*. Based on capsule and leaf morphology, *Grimmia brevirostris* and *G. hamulosa* are distinct. Although they are likely closely related species. The collections in the Russian Wilderness are new range

extensions to the Klamath Ranges. *Grimmia brevirostris* forms blackish patches on granitic rock walls and rockslabs in subalpine coniferous forests, especially where snowmelt flows over the rock surface for an extended period. The leaves are very narrow and linear when dry. Populations of *Grimmia brevirostris* are not common, but are widespread across the subalpine zone of the Russian Wilderness.

Specimens cited: **LS**: Pacific Crest Trail N of Carter Meadows Summit, 15 Aug 2020, 6975 ft, *Shevock 57281*; **RW**: slopes near South Sugar Lake, 31 Aug 1974, 6000 ft, *Norris & McGrew 45589, 45607* (UC); Paynes Lake, 2 Aug 1975, 6000 ft, *Norris & Smith 46348* (UC); trail above junction between Big Duck and Little Duck Lake, 3 Jul 2020, 6500 ft, *Shevock & Magnaghi 56960* and W side of Little Duck Lake, 3 Jul 2020, 6685 ft, *Shevock & Magnaghi 56953*; slopes above Bingham Lake, 31 Jul 2020, 7250 ft, *Shevock 57133* and E slope above Bingham Lake, 31 Jul 2020, 7145 ft, *Shevock 57139*; Pacific Crest Trail just S of Paynes Lake, 1 Aug 2020, 6540 ft, *Shevock & Brooks 57165, 57175* and *Brooks & Shevock 4048, 4049, 4064* (CAS); steep slope above Statue Lake, 2 Oct 2020, *Shevock & York 57480*; slopes above S end of Taylor Lake, 15 Oct 2020, 6650 ft, *Shevock 57652*; slope above E side of Eaton Lake, 17 Oct 2020, 6625 ft, *Shevock 57743*.

***Grimmia hamulosa* Lesq.**

This is a distinctive moss of subalpine areas in California (especially in the Sierra Nevada) that forms large dark brown to blackish patches on acidic boulders and rockslabs where water from snowmelt flows over the plants for an extended period. The slightly falcate, linear leaves with long-exserted capsules are good field characters. This moss is such an anomaly (based on morphological and anatomical characters) that Maier (2010) in her *Grimmia* monograph concluded that this species is not a *Grimmia*, although no other name is currently available. It is also a larger plant than *Grimmia brevirostris*, discussed above.

Specimens cited. **RW**: South Sugar Lake, 31 Aug 1974, 6000 ft, *Norris & McGrew 45609* (UC); walls above Sugar Lake, 25 Jul 1980, 1900 m, *Norris 57423* (UC); Pacific Crest Trail S of trail junction to Statue Lake overlooking South Russian Creek drainage, 2 Oct 2020, 6780 ft, *Shevock & York 57507*.

***Grimmia laevigata* (Brid.) Brid.**

This *Grimmia* Hedw., is very common at lower elevations in California, but in the project area it was found only once in sterile condition. It is typically found on very exposed rock in dense hoary cushions that sometimes cover extensive areas. Even when sterile, this species of *Grimmia* is easy to recognize in the field.

Specimen cited: **LS**: county road 1C01 at junction with forest road 40N61 above the North Fork Salmon River, 25 Feb 2021, 2470 ft, *Shevock 57975*.

***Grimmia leibergii* Paris**

This species can form robust populations covering boulders and can easily be mistaken for *Bucklandiella heterosticha* or *B. affinis*. However, its side branches are not as obvious and its capsules are ovoid and ribbed rather than smooth and cylindrical. An alternate placement for this moss is in the genus *Dryptodon*.

Specimens cited. **LS**: forest road 40N54 at Russian Creek just beyond county road 1C01, 21 Jun 2020, 2695 ft, *Shevock 56904*; North Russian Creek on county road 1C01, 2 mi E of North Fork Salmon River Bridge, 16 Aug 2020, 3035 ft, *Shevock 57300*; forest highway 39, 0.6 mi from junction with county road 1C02, 27 Oct 2020, 4130 ft, *Shevock 57865*; off county road 1C01 along rocky banks of North Fork Salmon River near bridge crossing of forest road 40N61, 2 Dec 2020, 3550 ft, *Shevock 57951*.

***Grimmia lisae* DeNot.**

This species closely resembles *Grimmia trichophylla* Grev., but the plants are usually darker green and have less acuminate leaves. When wet, the leaves have a squarrose-recurved stance on the stems. It is apparently rare in the study area, but is more common at lower elevations.

Specimens cited. **LS**: county road 1C01 about 18 mi from Etna, 18 May 1972, 850 m, *Norris & Hermann 22739* (UC); county road 1C01, 1.5 mi W of North Fork Salmon River Bridge from Idlewild Campground, 25 Feb 2021, 2500 ft, *Shevock 57993*.

***Grimmia montana* Bruch & Schimp.**

This is the most common *Grimmia* within the Russian Wilderness region. It is only likely to be confused with *Grimmia alpestris* when in a sterile condition, but sporophytes are usually present.

Specimens cited. **LS**: end of 1.3 mi long logging spur road to Little Jackson Creek off of county road 1C02 just below Carter Meadows Summit, 13 Jun 2020, 5575 ft, *Shevock 56766*; Meeks Meadow Creek below Meeks Meadow Lake, 16 Oct 2020, 6185 ft, *Shevock 57711*; county road 1C01, 1.5 mi W of North Fork Salmon River Bridge from Idlewild Campground, 25 Feb 2021, 2500 ft, *Shevock 57994*; **RW**: trail to Sugar Lake, 20 Jun 2012, 5800 ft, *Shevock 40383* and slopes above Sugar Lake, 6 Oct 2012, 5975 ft, *Shevock & Kellman 41174* and *Kellman & Shevock 6945* (CAS); trail below junction to Big Duck Lake and Little Duck Lake; 3 Jul 2020, 5800 ft, *Shevock & Magnaghi 56977*; below outlet of Taylor Lake, 2 Aug 2020, 6400 ft, *Shevock & Brooks 57207*; trail midpoint between Taylor Lake and Hogan Lake, 28 Aug 2020, 6000 ft, *Shevock & Magnaghi 57350*; slopes above Statue Lake, 2 Oct 2020, 7200 ft, *Shevock & York 57479*.

***Grimmia ovalis* (Hedw.) Lindb.**

Grimmia ovalis grows on exposed rock and is apparently rare in the study area. The leaves have plane margins and the costa is not projecting on the abaxial surface. Additionally, the basal leaf cells are long, thick-walled, and yellowish.

Specimens cited. **LS**: county road 1C01, 1.5 mi W of North Fork Salmon River Bridge from Idlewild Campground, 25 Feb 2021, 2500 ft, *Shevock* 57997; **RW**: outlet creek of Taylor Lake, 1 Aug 2020, 6500 ft, *Brooks & Shevock* 4082 (CAS).

Grimmia pulvinata (Hedw.) Sm.
Plants are ashy-gray in color due to long hairpoints. Capsules are commonly produced on an arcuate seta. The operculum is long rostrate and the calyptra is mitrate. It is restricted to the lower elevations of the project area. Although it prefers boulders, it also is common on concrete bridge foundations.
Specimens cited. **LS**: forest road 40N54 at Russian Creek Bridge just off county road 1C01, 1 Aug 2020, 2580 ft, *Shevock* 57164; North Fork Salmon River just above junction with forest road 40N61, 4 Oct 2020, 2380 ft, *Shevock* 57602.

Grimmia torquata Drumm.
This species forms dense tufts primarily on vertical rock walls and has a glassy appearance under magnification. The hairpoints are very short and the leaves, when dry, are twisted and contorted in a very characteristic manner. Sporophytes are rare.
Specimens cited. **LS**: county road 1C01 at Mill Creek 5 mi SW of Etna, 31 Jul 2020, 3950 ft, *Shevock* 57154; South Russian Creek Trail about 1 mi above the trailhead, 30 Aug 2020, 4690 ft, *Shevock & Magnaghi* 57420; Sixmile Creek above county road 1C02, 26 Oct 2020, 4025 ft, *Shevock* 57826; **RW**: outlet of Taylor Lake, 2 Aug 2020, 6400 ft, *Shevock & Brooks* 57204; South Russian Creek Trail between wilderness boundary and the switchbacks, 3 Oct 2020, 5300 ft, *Shevock & York* 57528; Sugar Creek about 0.5 mi above forest road 41N14, 28 Oct 2020, 4840 ft, *Shevock* 57882.

Grimmia trichophylla Grev.
This is likely the most common species of *Grimmia* in California and also one of the most variable. Capsules are occasional and are ovoid, ribbed with a rostrate operculum. The seta is arcuate.
Specimens cited. **LS**: county road 1C01, North Fork Russian Creek, 2 mi above North Fork Salmon River Bridge, 16 Aug 2020, 3035 ft, *Shevock* 57304; county road 1C01 at Taylor Creek just above confluence with North Russian Creek, 27 Aug 2020, 3570 ft, *Shevock* 57343; forest road 41N14, 0.1 mi S of Paynes Lake Trailhead, 18 Oct 2020, 4350 ft, *Shevock* 57773; county road 1C01, 4.7 mi W of Etna Summit paralleling North Fork Russian Creek near confluence with Taylor Creek, 2 Dec 2020, 3490 ft, *Shevock* 57928; **RW**: outlet of Taylor Lake, 2 Aug 2020, 6400 ft, *Shevock & Brooks* 57205.

Grimmia sp. 1
This moss is an undescribed species. It has basal marginal cells with thin longitudinal and transverse walls, leaves with long hairpoints, and another very usual feature is the extremely thin setae.
Specimens cited: **RW**: Pacific Crest Trail just S of Paynes Lake on granitic rock wall, 1 Aug 2020, 6540

ft, *Shevock & Brooks* 57174 and *Brooks & Shevock* 4056 (CAS); E slope of Eaton Lake, 17 Oct 2020, 6625 ft, *Shevock* 57745.

Hedwigia detonsa (M.Howe) W.R.Buck & D.H.Norris
This plant grows in loose, procumbent mats on rock. The perichaetial leaves lack the ciliate margins of *Hedwigia ciliata* (Hedw.) P.Beauv. Although it is a subtle difference, plants of this species appear grayish green compared with *H. stellata* Hedenäs, which is yellowish green.
Specimen cited. **LS**: forest highway 39, 0.6 mi from junction with county road 1C02, 27 Oct 2020, 4130 ft, *Shevock* 57862.

Hedwigia stellata Hedenäs
Growing in loose mats with a hoary appearance, this saxicolous moss has immersed, globose capsules lacking a peristome. Contrasted with *Hedwigia detonsa* it has ciliate perichaetial leaves.
Specimen cited. **LS**: Russian Creek below bridge crossing on forest road 40N54, 16 Oct 2020, 2580 ft, *Shevock* 57664.

Herzogiella seligeri (Brid.) Z.Iwats.
This is a light-green colored moss, usually occurring on rotten conifer logs. These plants grow in thin mats in shade to filtered light, often mixed with other mosses. The uniquely curved leaves with short, double costa and serrate upper leaf margins are good diagnostic characters. Sporophytes are usually common.
Specimens cited. **RW**: South Russian Creek Trail between the wilderness boundary and the switchbacks, 3 Oct 2020, 5285 ft, *Shevock & York* 57519; Eaton Lake Trail, 17 Oct 2020, 5675 ft, *Shevock* 57721.

Homalothecium californicum Hedenäs, Huttunen, Shevock & D.H.Norris
This is a showy species that is nearly endemic to mountainous northern California. It is most frequently located along riparian corridors where it occurs on boulders and rock walls above the high water zone or other protected areas such as under tree canopies. The curved and asymmetric capsules are uncommon. Compared to *H. nevadense* (Lesq.) Renauld & Cardot, the plants are more robust and the shoot tips are more circinately coiled. However, the golden-green hamate stems are more similar in appearance to *Trachybryum megaptilum* (Sull.) W.B.Schof. See Hedenäs et al. (2009) for illustrations.
Specimens cited. **LS**: forest road 41N14 at Sugar Creek, 5 mi N of county road 1C02, 20 Jun 2012, 4775 ft, *Shevock* 40417; forest road 40N54 just off of county road 1C01 along Russian Creek, 21 Jun 2020, 2695 ft, *Shevock* 56903; county road 1C01 at Mill Creek 5 mi SW of Etna, 31 Jul 2020, 3950 ft, *Shevock* 57155; Sixmile Creek above county road 1C02, 26 Oct 2020, 4025 ft, *Shevock* 57824; forest highway 39, 1.1 mi from junction with county road 1C02, 27 Oct

2020, 4530 ft, *Shevock* 57856; **RW**: South Russian Creek off trail between the wilderness boundary and switchbacks, 3 Oct 2020, 5300 ft, *Shevock & York* 57526.

Homalothecium fulgens (Mitt. ex Müll.Hal.) E.Lawton

This fairly large species is not so strongly pinnately branched, nor does it extend as far south in California, as other members of this genus. In the study area, it prefers hardwood trunks and is found within lower elevation riparian corridors.

Specimens cited. **LS**: county road 1C02 at Shadow Creek, 13 Jun 2020, 2870 ft, *Shevock* 56785; county road 1C01, North Russian Creek, 2 mi above North Fork Salmon River Bridge, 16 Aug 2020, 3035 ft, *Shevock* 57289; Whites Gulch Creek just below junction with East Fork Whites Gulch Trail, 4 Oct 2020, 2775 ft, *Shevock* 57614; county road 1C01 at Robinson Gulch, 1.6 mi above junction with forest road 41N61, 25 Feb 2021, 2635 ft, *Shevock* 57979.

Homalothecium nevadense (Lesq.) Renauld & Cardot

This species of *Homalothecium* Schimp., generally occurs in drier areas and usually at higher elevations, where it occurs on boulders and rock walls. When fertile, the straight and cylindrical capsules immediately distinguish it from all other *Homalothecium* species in the area. Plants can be medium sized to rather robust.

Specimens cited. **LS**: Paynes Lake Trail near forest road 41N14, 7 Jul 2003, 1450 m, *Norris & Hillyard* 105757 (UC); county road 1C01, 3.8 mi E of Etna Summit toward Mill Creek, 21 Jun 2020, 4300 ft, *Shevock* 56916; forest road 39N48 at switchbacks above Carter Meadows Summit off of county road 1C02, 15 Aug 2020, 6500 ft, *Shevock* 57285; South Russian Creek Trail less than 0.5 mi from trailhead, 30 Aug 2020, 4650 ft, *Shevock & Magnaghi* 57415; Russian Creek below forest road 40N54, 16 Oct 2020, 2580 ft, *Shevock* 57666; forest highway 39, 0.7 mi E of junction with road 39N58, 27 Oct 2020, 6025 ft, *Shevock* 57845; county road 1C01, 2.8 mi W of Etna Summit, 2 Dec 2020, 4340 ft, *Shevock* 57902; **RW**: trail to Sugar Lake, 20 Jun 2012, 5700 ft, *Shevock* 40413 and 6 Oct 2012, 1610 m, *Kellman & Shevock* 6954 (CAS); below outlet of Taylor Lake, 2 Aug 2020, 6400 ft, *Shevock & Brooks* 57201; trail between Taylor Lake and Hogan Lake, 28 Aug 2020, 6030 ft, *Shevock & Magnaghi* 57356; South Russian Creek Trail at wilderness boundary, 3 Oct 2020, 5195 ft, *Shevock & York* 57516.

Homalothecium nuttallii (Wilson) A.Jaeger

This species forms green to golden-green long creeping stems, mostly on hardwood bark. In the study area, it is restricted to lower elevation riparian areas.

Specimens cited. **LS**: county road 1C01, North Russian Creek 2 mi above North Fork Salmon River Bridge, 16 Aug 2020, 3035 ft, *Shevock* 57301; Russian Creek below forest road 40N54, 16 Oct 2020, 2580 ft,

Shevock 57665; Shadow Creek off county road 1C02, 27 Oct 2020, 3270 ft, 3270 ft, *Shevock* 57836; forest road 39N20, 1 mi above junction with county road 1C02, 27 Oct 2020, 3330 ft, *Shevock* 57838; county road 1C01 about 2.2 mi SW of Idlewild Campground and just above bridge crossing of North Fork Salmon River of forest road 40N61, 2 Dec 2020, 2550 ft, *Shevock* 57950.

Homalothecium pinnatifidum (Sull. & Lesq.) E.Lawton

This species is quite variable in habit, where it can occur on soil, tree bark, or boulders forming very loose to fairly dense mats. When identification is in doubt, the alar cell areas should be examined microscopically.

Specimens cited. **LS**: Russian Creek above forest road 40N54 just off of county road 1C01, 21 Jun 2020, 2695 ft, *Shevock* 56909; forest road 41N14 at French Creek, 7 mi N of county road 1C02 and 2 mi N of Sugar Lake Trailhead, 13 Aug 2020, 4195 ft, *Shevock* 57229; forest highway 39, 1.1 mi above junction with county road 1C02, 27 Oct 2020, 4530 ft, *Shevock* 57857; **RW**: trail toward Big Duck and Little Duck Lake, 3 Jul 2020, 6000 ft, *Shevock & Magnaghi* 56972.

Hookeria lucens (Hedw.) Sm.

At first glance this taxon from northern coastal forests would most likely be viewed as some type of a herbarium processing error, even though the specimen is correctly identified. However, this collection, as is the standard procedure for Norris collections, has the collection number cut from the paper collecting bag placed inside the herbarium packet with the label data matching the entry in his field notebook. Therefore, we accept this record (even though this locality is remarkable and unexpected), since it occurs farther inland than coastal localities from Del Norte to Mendocino counties where all of the other California occurrences of *Hookeria lucens* are documented. In addition, this occurrence in the Russian Wilderness is considerably higher in elevation.

Specimen cited. **RW**: Sugar Creek above Sugar Lake, 25 Jul 1980, 4800–6000 ft, *Norris* 57327 (UC).

Hygrohypnella ochracea (Turner ex Wilson) Ignatov & Ignatova

[*Hygrohypnum ochraceum*]

This is a common and showy species primarily on rock walls and boulders either along streams or intermittent stream channels, where it is seasonally inundated to submerged. The dried plants have a rather glossy sheen, although they can be variable in size and leaf stance depending how long plants remain hydrated and how water moves over the plants.

Specimens cited: **LS**: Upper Ruffey Lake, 22 Jul 2006, 6615 ft, *Lenz* 3100, 3103 (CAS) and 16 Oct 2020, 6600 ft, *Shevock* 57673, 57678; county road 1C01 at Taylor Creek just above confluence with North Russian Creek, 27 Aug 2020, 3570 ft, *Shevock*

57341; forest road 40N54, 0.2 mi below crossing of South Russian Creek, 30 Aug 2020, 4100 ft, *Shevock* 57433; forest road 39N20 at Campbell Spring, 27 Oct 2020, 6050 ft, *Shevock* 57844; **RW**: Paynes Lake, 2 Aug 1975, 6000 ft, *Norris & Smith* 46359 (UC); Taylor Lake, 19 Aug 1994, 1950 m, *Norris* 83387 (UC); S side of Little Duck Lake, 3 Jul 2020, 6550 ft, *Shevock & Magnaghi*, 56940; between Albert Lake and Upper Albert Lake, 1 Aug 2020, 6900 ft, *Shevock & Brooks* 57177, 57182; S side of Albert Lake, 1 Aug 2020, 6965 ft, *Brooks & Shevock* 4060, 4062 (CAS); Taylor Lake, 4 Jul 2006, 6500 ft, *Lenz* 3042, 3043 (CAS); below outlet of Taylor Lake, 2 Aug 2020, 6400 ft, *Shevock & Brooks* 57192 and *Brooks & Shevock* 4074 (CAS); just below lake outlet of Upper Albert Lake, 14 Aug 2020, 7095 ft, *Shevock* 57253; outlet of Russian Lake, 29 Aug 2020, 7020 ft, *Shevock & Magnaghi* 57405, 57406; S end of Taylor Lake, 1 Oct 2020, 6465 ft, *Shevock* 57445; Pacific Crest Trail at junction of trail to Statue Lake, 2 Oct 2020, 6925 ft, *Shevock & York* 57475.

Hylocomiadelphus triquetrus (Hedw.) Ochyra & Stebel

[*Rhytidiadelphus triquetrus*]

This is a large and showy moss that would not be confused with any other species in the study area. It occurs on leaf litter. Populations of this coarse, shaggy moss are sporadically distributed in northern California.

Specimens cited. **LS**: Duck Lake Trail near forest road 41N14, 11 Jun 1972, ~5500 ft, *Norris* 22861 (UC); county road 1C02 at Sixmile Creek, 27 Oct 2019, 3995 ft, *Shevock & Liu* 55466; along forest road 40N38 near junction with 40N61 above S bank of the North Fork Salmon River, 4 Oct 2020, 2410 ft, *Shevock* 57593; county road 1C01, 4.7 mi W of Etna Summit paralleling North Fork Russian Creek, 2 Dec 2020, 3490 ft, *Shevock* 57916.

Hymenoloma crispulum (Hedw.) Ochyra

[*Dicranoweisia crispula*]

This species resembles *Dicranoweisia cirrata*, but is contrasted by its rupestral habitat and more linear leaves with cuticular papillae. In Norris and Shevock (2004a, b), this species was misapplied as *Dicranoweisia contermina* Renauld & Cardot.

Specimens cited. **LS**: Little Jackson Creek at end of 1.3 mi spur road off of county road 1C02 just below Carter Meadows Summit, 13 Jun 2020, 5575 ft, *Shevock* 56768; forest road 41N16 toward Jackson Lake, 2.2 mi from county road 1C02, 30 Jul 2020, 5465 ft, *Shevock* 57111; South Russian Creek Trail about 1 mi from trailhead, 30 Aug 2020, 4690 ft, *Shevock & Magnaghi* 57425; **RW**: trail to Sugar Lake, 20 Jun 2012, 5800 ft, *Shevock* 40381 and slopes above Sugar Lake, 6 Oct 2012, 5975 ft, *Shevock & Kellman* 41176; S side of Little Duck Lake, 3 Jul 2020, 6550 ft, *Shevock & Magnaghi* 65937, 56938a, 56948; Paynes Lake Trail just below crossing of Paynes Lake Creek, 14 Aug 2020, 5600 ft, *Shevock* 57264; trail between Taylor Lake and Hogan Lake, 28 Aug 2020, 6030 ft,

Shevock & Magnaghi 57367; Pacific Crest Trail S of Music Creek Trail junction toward Statue Lake, 2 Oct 2020, 6900 ft, *Shevock & York* 57469, 57472 and S of junction with trail to Statue Lake, 2 Oct 2020, 6950 ft, *Shevock & York* 57503; Eaton Lake Trail, 17 Oct 2020, 5830 ft, *Shevock* 57732; E slope of Eaton Lake, 17 Oct 2020, 6625 ft, *Shevock* 57742.

Hymenostylium recurvirostrum (Hedw.) Dixon

This species might be confused with *Bryoerythrophyllum recurvirostrum*, but it grows in denser tufts and the lower parts are never rusty-red. Its habitat preference is seasonally seepy soil over rock and the plants are often infiltrated with lime deposits. The basal leaf cells of the two are distinctly different.

Specimen cited. **LS**: forest road 40N54, 1 mi from junction with county road 1C01, 25 Mar 2021, 2990 ft, *Shevock* 58158.

Imbribryum miniatum (Lesq.) J.R.Spence

[*Bryum miniatum*]

This showy rheophyte is highly distinctive with its red to reddish-green, strongly julaceous, and shiny stems. It can also occur on seasonally moist seeps over rock.

Specimens cited. **LS**: forest road 40N54, 3.6 mi above bridge crossing of South Russian Creek, 1 Aug 2020, 5560 ft, *Shevock & Brooks* 57187, 57188; Pacific Crest Trail north of Carter Meadows Summit, 15 Aug 2020, 7080 ft, *Shevock* 57279; trail from Deacon Lee Trailhead toward Waterdog Lake, 29 Aug 2020, 6540 ft, *Shevock & Magnaghi* 57389; below outlet of Upper Ruffey Lake, 16 Oct 2020, 6550 ft, *Shevock* 57692; county road 1C02, 0.9 mi W of Trail Creek, 27 Oct 2020, 4530 ft, *Shevock* 57872; **RW**: Bingham Lake, 1 Sep 1974, 2200 m, *Norris* 45689 (UC); Paynes Lake, 2 Aug 1975, 6000 ft, *Norris & Smith* 46321 (UC); N side of Hogan Lake, 28 Aug 2020, 5935 ft, *Shevock & Magnaghi* 57377.

Imbribryum muehlenbeckii (Bruch & Schimp.) N.Pedersen

[*Bryum muehlenbeckii*]

Typically a moss of wet rocks along streams or in snowmelt areas, it forms dark reddish-green tufts. The leaves are concave and broadly pointed with a red, percurrent costa.

Specimens cited. **RW**: below outlet of Russian Lake, 29 Aug 2020, 7020 ft, *Shevock & Magnaghi* 57409.; fen at headwaters of South Russian Creek, 3 Oct 2020, 6115 ft, *Shevock & York* 57555.

Imbribryum sp. 1.

This specimen most likely belongs in the genus *Imbribryum* N.Pedersen, however, an existing name and species description could not be found to match these plants at this time. We speculate that it is most likely an undescribed species. However, it could also be a new ecological expression of *Imbribryum torenii* J.R.Spence & Shevock. This hypothesis requires a phylogenetic study.

Specimen cited. **LS**: along the Pacific Crest Trail N of Carter Meadows Summit, 15 Aug 2020, 7080 ft, *Shevock* 57278.

Imbriobryum torenii J.R.Spence & Shevock

This species, recently described (Spence and Shevock 2015), is a plant of seasonally moist areas on rock or soil over rock. Sporophytes are occasional in its range, but absent in the study area. The leaves are mostly broadly ovate in shape and the upper parts of the shoots are tinted reddish. Evidently it is rare in the area.

Specimens cited. **LS**: along North Fork Salmon River above bridge crossing of forest road 40N61, 4 Oct 2020, 2580 ft, *Shevock* 57606 (det. by Spence); W side of Upper Ruffey Lake, 16 Oct 2020, 6600 ft, *Shevock* 57695; **RW**: slopes near South Sugar Lake, 31 Aug 1974, 6000 ft, *Norris & McGrew* 45593 (UC).

Isopterygiopsis pulchella (Hedw.) Z.Iwats.

This species grows in thin, bright green to yellow-green mats in shaded rocky recesses or over exposed tree roots. Usually fruiting, it might be mistaken for a small *Brachytheciastrum* Ignatov & Huttunen, but is quickly distinguished by the costa, which is lacking or short and double, and the more slender capsule.

Specimen cited. **RW**: Taylor Lake, 4 Jul 2006, 6500 ft, *Lenz* 3027 (UC), det. confirmed by J.T.Wynns.

Isothecium cristatum (Hampe) H.Rob.

Compared with *Isothecium stoloniferum* Brid., this moss forms dense thinner mats with fewer branches and often has a russet coloration. Sporophytes are infrequent to common.

Specimens cited. **LS**: county road 1C02 at Shadow Creek above confluence with East Fork of South Fork Salmon River, 13 Jun 2020, 2870 ft, *Shevock* 56784; South Russian Creek Trail less than 0.5 mi from the trailhead, 30 Aug 2020, 4650 ft, *Shevock & Magnaghi* 57430; county road 1C01, 4.7 mi W of Etna Summit paralleling North Fork Russian Creek, 2 Dec 2020, 3490 ft, *Shevock* 57914; forest road 40N61, 0.1 mi from junction with county road 1C01 and North Fork Salmon River, 25 Mar 2021, 2300 ft, *Shevock* 58163.

Isothecium stoloniferum Brid.

This is a common and large pleurocarpous moss most often occurring on boulders, but it can also colonize trees especially within riparian corridors. It can be the dominant species in some lower elevation areas. Sporophytes are rare to uncommon.

Specimens cited. **LS**: county road 1C02 at Sixmile Creek, 27 Oct 2019, 3995 ft, *Shevock & Liu* 55473; county road 1C02 at Shadow Creek above confluence with the East Fork of the South Fork Salmon River, 13 Jun 2020, 2870 ft, *Shevock* 56787 and 21 Jun 2020, 3310 ft, *Shevock* 56883; county road 1C01, 4.9 mi W of Etna Summit and 1.8 mi from North Fork Salmon River Bridge, 31 Jul 2020, 3590 ft, *Shevock* 57160; North Fork Russian Creek, county road 1C01, 2 mi above North Fork Salmon River Bridge, 16 Aug 2020, 3035 ft, *Shevock* 57298; county road 1C01 at

Mill Creek 5 mi SW of Etna, 27 Aug 2020, 3950 ft, *Shevock* 57317; Jackson Creek above county road 1C02, 26 Oct 2020, 4500 ft, *Shevock* 57797; Trail Creek above crossing of forest road 39N06, 26 Oct 2020, 4850 ft *Shevock* 57803; county road 1C01 at junction with forest road 41N22 paralleling North Fork Russian Creek above confluence with Cow Creek, 2 Dec 2020, 3260 ft, *Shevock* 57940.

Kiaeria blyttii (Schimp.) Broth.

Kiaeria I.Hagen, is a genus that in northern California is restricted to subalpine areas. Both *Kiaeria* species in the Russian Wilderness have the aspect of a small *Dicranum* Hedw., but are separated by a suite of microscopic characters.

Specimens cited. **RW**: slopes above Sugar Lake, 6 Oct 2012, 5975 ft, *Kellman & Shevock* 6949 (CAS) and *Shevock & Kellman* 41178; slopes above Statue Lake, 2 Oct 2020, 7200 ft, *Shevock & York* 57486; slope above S end of Taylor Lake, 15 Oct 2020, 6650 ft, *Shevock* 57654.

Kiaeria starkei (F.Weber & D.Mohr) I.Hagen

This species is yellow-green in color, whereas *K. blyttii* is blackish-green. It also appears to be more common than *K. blyttii*.

Specimens cited. **RW**: head of Sugar Lake, 18 Aug 1973, 5900 ft, *McGrew* 0006 (UC); slopes near South Sugar Lake, 31 Aug 1974, 1900 m, *Norris & McGrew* 45629, 45651 (UC); Bingham Lake, 1 Sep 1974, 7000 ft, *McGrew* 0624, 0626, 0631, 0660 (UC); Russian Lake, 9 Sep 1974, 7000 ft, *McGrew* 0361, 0378 (UC); trail to Little Duck Lake above junction of trail to Big Duck Lake, 3 Jul 2020, 6600 ft, *Shevock & Magnaghi* 56958; Pacific Crest Trail just S of Paynes Lake, 1 Aug 2020, 6540 ft, *Shevock & Brooks* 57168 and *Brooks & Shevock* 4050 (CAS); slope above S end of Taylor Lake, 15 Oct 2020, 6650 ft, *Shevock* 57645, 57650; E slope above Eaton Lake, 17 Oct 2020, 6625 ft, *Shevock* 57774.

Kindbergia oregana (Sull.) Ochyra

This large and showy species is restricted to the lowest elevations of the study area in mixed conifer forests with a hardwood component. It can grow on leaf litter, tree bases, rotten wood, and logs or even litter over rock. *Kindbergia oregana* is one of the most common pleurocarpous mosses in forests that receive greater precipitation.

Specimens cited. **LS**: forest road 40N38 just off of 40N61 adjacent to the S side of the North Fork Salmon River, 4 Oct 2020, 2410 ft, *Shevock* 57597; county road 1C01 at Mill Creek 5 mi SW of Etna, 15 Oct 2020, 3950 ft, *Shevock* 57630; Russian Creek below forest road 40N54 just above confluence with North Fork Salmon River, 16 Oct 2020, 2580 ft, *Shevock* 57661; Jackson Creek above county road 1C02, 26 Oct 2020, 4500 ft, *Shevock* 57788; Shadow Creek off county road 1C02, 27 Oct 2020, 3270 ft, *Shevock* 57832; county road 1C01, 4.7 mi W of Etna Summit paralleling North Fork Russian Creek, 2 Dec 2020, 3490 ft, *Shevock* 57917.

Kindbergia praelonga (Hedw.) Ochyra

A common moss associated with moist to wet places along streams and springs, usually with some shade. It can be variable in size, but generally it is smaller and brighter green in color than *K. oregana*.

Specimens cited. **LS**: forest road 41N16 toward Jackson Lake at small tributary to Jackson Creek, 2.7 mi from junction with county road 1C02, 30 Jul 2020, 5600 ft, *Shevock 57113, 57115*; forest road 41N14 at Horse Range Creek, 0.8 mi S of Paynes Lake Trailhead, 14 Aug 2020, 4490 ft, *Shevock 57372*; county road 1C01, along North Russian Creek 2 mi above North Fork Salmon River Bridge, 16 Aug 2020, 3035 ft, *Shevock 57308*; county road 1C01 at Mill Creek 5 mi SW of Etna, 27 Aug 2020, 3950 ft, *Shevock 57315*; South Russian Creek Trail about 0.5 mi below the wilderness boundary, 3 Oct 2020, 5000 ft, *Shevock & York 57510*; forest road 41N14, 0.1 mi S of Paynes Lake Trailhead, 18 Oct 2020, 4350 ft, *Shevock 57763*; Jackson Creek above county road 1C02, 26 Oct 2020, 4500 ft, *Shevock 57793*; Trail Creek above crossing of forest road 39N06, 26 Oct 2020, 4850 ft, *Shevock 57812*; forest highway 39, 2 mi E of junction with road 39N58, 27 Oct 2020, 5920 ft, *Shevock 57851*; **RW**: Sugar Creek, 18 Aug 1973, 5900 ft, *McGrew 0039, 0100* (UC) and above Sugar Lake, 25 Aug 1973, 6000 ft, *McGrew 0161, 0162, 0178* (UC); Golden Russian Lakes, 8 Sep 1973, 6400 ft, *McGrew 0360* (UC); Eaton Lake Trail near junction with Duck Lake Trail, 17 Oct 2020, 5700 ft, *Shevock 57727*; Sugar Creek about 0.5 mi above forest road 41N14, 28 Oct 2020, 4920 ft, *Shevock 57889*.

Leptobryum pyriforme (Hedw.) Wilson

This moss can be recognized by its blackish stem bases, setaceous leaves, and glossy, pyriform capsules. It grows in soft tufts on moist, disturbed soil and is somewhat weedy.

Specimens cited. **LS**: Duck Lakes Trail above forest road 41N14, 11 Jun 1972, 5500 ft, *Norris 22830* (UC); Paynes Creek at forest road 41N14, 2 Aug 1975, 5500 ft, *Norris & Smith 46279, 46280* (UC); Duck Lake Trail near forest road 41N14, 11 Jun 1972, 5500 ft, *Norris 22830* (UC); dripping vertical wall of Cow Creek just above county road 1C01 at junction with forest road 40N22, 2 Dec 2020, 3260 ft, *Shevock 57938*.

Leucolepis acanthoneura (Schwägr.) Lindb.

This is a highly distinctive moss that resembles miniature palm trees. It prefers moist soil along stream banks in filtered light.

Specimens cited. **LS**: Shadow Creek off of county road 1C02, 13 Jun 2020, 2870 ft, *Shevock 56790*; Mill Creek at county road 1C01, 5 mi SW of Etna, 27 Aug 2020, 3950 ft, *Shevock 57309*; county road 1C01 at spring, 3.4 mi W of Etna Summit just below Jumpoff Joe Curve, 27 Aug 2020, 4115 ft, *Shevock 57329*; along forest road 40N38 along North Fork Salmon River near junction with road 40N61, 4 Oct 2020, 2410 ft, *Shevock 57598*; Whites Gulch Creek

along forest road 40N61 at junction with East Fork Whites Gulch Trail, 4 Oct 2020, 2775 ft, *Shevock 57515*; forest road 41N14, 0.1 mi S of Paynes Lake Trailhead, 18 Oct 2020, 4350 ft, *Shevock 57762*; Sixmile Creek above county road 1C02, 26 Oct 2020, 4025 ft, *Shevock 57822*; **RW**: trail to Sugar Lake, 6 Oct 2012, 1700 m, *Kellman & Shevock 6910* (CAS).

Lewinskya arida Vigalondo, F.Lara & Garilleti

Based on molecular evidence, the genus *Lewinskya* F.Lara, Garilleti & Goffinet was established to accommodate the superficial stomatose taxa within *Orthotrichum* Hedw. (Lara et al. 2016). This species is part of the *Orthotrichum affine* Schrad. ex Brid., complex now as *Lewinskya affinis* (Schrad. ex Brid.) F.Lara, Garilleti & Goffinet. In Norris and Shevock (2004a, b) and in *Flora of North America North of Mexico* (Flora of North America Editorial Committee 2014) the western North American material named as *Orthotrichum affine* was misapplied (Vigalondo et al. 2020). Recent molecular studies determined that the Pacific West plants are a separate lineage of three recently described species, all of which occur in California. See Vigalondo et al. (2020) for descriptions and illustrations. *Lewinskya arida* prefers tree trunks or exposed roots. It has strongly recurved leaf margins compared with other species of this complex.

Specimens cited. **LS**: county road 1C01 about 18 mi W from Etna, 18 May 1972, 2800 ft, *Norris & Hermann 22748* (UC); forest road 41N14, 0.1 mi S of Paynes Lake Trailhead at tributary of Horse Range Creek, 18 Oct 2020, 4350 ft, *Shevock 57765*; **RW**: Sugar Lake, 25 Aug 1973, 5900 ft, *McGrew 0109, 0122* (UC); trail between Taylor Lake and Hogan Lake, 28 Aug 2020, 6030 ft, *Shevock & Magnaghi 57364*.

Lewinskya laevigata (J.E.Zetters.) F.Lara, Garilleti & Goffinet

[*Orthotrichum laevigatum*]

Capsules of this species are frequently produced. The smooth to slightly ribbed capsules are borne on long setae.

Specimens cited. **LS**: Etna Creek about 4 mi from Etna, 17 May 1972, 3800 ft, *Norris & Hermann 22688* (UC); forest road 39N48 at switchbacks above Carter Meadows Summit, 15 Aug 2020, 6400 ft, *Shevock 57286*; Meeks Meadow Creek above Meeks Meadow Lake, 16 Oct 2020, 6225 ft, *Shevock 57717*; **RW**: trail to Sugar Lake, 20 Jun 2012, 4680 ft, *Shevock 40380*, below lake outlet, 20 Jun 2012, 5935 ft, *Shevock 40398, 40402*; trail to Big Duck and Little Duck Lake, 3 Jul 2020, 5800 ft, *Shevock & Magnaghi 56974*; outlet of Taylor Lake, 2 Aug 2020, 6400 ft, *Shevock & Brooks 57198* and *Brooks & Shevock 4073, 4080* (CAS); Paynes Lake Trail above crossing of Paynes Lake Creek, 14 Aug 2020, 6000 ft, *Shevock 57243*; N facing slope of Hogan Lake, 28 Aug 2020, 5960 ft, *Shevock & Magnaghi 57378*.

Lewinskya pylaisii (Brid.) F.Lara, Garilleti & Goffinet

[*Orthotrichum pylaisii*]

Lewinskya pylaisii is a rather large member of this genus that generally prefers vertical rock walls. It produces abundant sporophytes on short setae.

Specimens cited. **RW**: Sugar Lake Trail, 6 Oct 2012, 1580 m, *Kellman & Shevock 6906* (CAS); trail to Little Duck Lake above junction with trail to Big Duck Lake, 3 Jul 2020, 6500 ft, *Shevock & Magnaghi 56966*; outlet of Taylor Lake, 2 Aug 2020, 6400 ft, *Shevock & Brooks 57206*; trail between Taylor Lake and Hogan Lake, 28 Aug 2020, 5025 ft, *Shevock & Magnaghi 57384*; slope above S end of Taylor Lake, 15 Oct 2020, 6650 ft, *Shevock 57657*.

Lewinskya rupestris (Schleich. ex Schwägr.) F.Lara, Garilleti & Goffinet

[*Orthotrichum rupestre*]

This is the most common species of *Lewinskya* in the study area. It is fairly distinctive since the growth habit is usually spreading and sporophytes appear to be axillary rather than terminal. It is common along riparian corridors, especially on boulders.

Specimens cited. **LS**: Russian Creek above forest road 40N54 just off of county road 1C01, 21 Jun 2020, 2695 ft, *Shevock 56908*; Paynes Lake Trail, 14 Aug 2020, 5485 ft, *Shevock 57267*; forest road 39N48 at switchbacks above Carter Meadows Summit, 15 Aug 2020, 6400 ft, *Shevock 57283*; county road 1C01 along North Russian Creek, 2 mi above North Fork Salmon River Bridge, 16 Aug 2020, 3035 ft, *Shevock 57292*; county road 1C01 at Taylor Creek just above confluence with North Russian Creek, 27 Aug 2020, 3570 ft, *Shevock 57340*; South Russian Creek Trail, less than 0.5 mi from trailhead, 30 Aug 2020, 4650 ft, *Shevock & Magnaghi 57412*; forest highway 39, 0.7 mi from junction with road 39N58, 27 Oct 2020, 6025 ft, *Shevock 57848*; county road 1C01 about 2.2 mi SW of Idlewild Campground and just above bridge crossing of North Fork Salmon River of forest road 40N61, 2 Dec 2020, 2550 ft, *Shevock 57945*; Whites Gulch Creek along forest road 40N61, 0.5 mi from county road 1C01, 2 Dec 2020, 2500 ft, *Shevock 57955*; confluence of North Russian and South Russian Creeks, 25 Feb 2021, 2665 ft, *Shevock 57982, 57985*; North Fork Salmon River paralleling county road 1C01, 1.8 mi W of Idlewild Campground, 25 Feb 2021, 2480 ft, *Shevock 58004*.

Meiotrichum lyallii (Mitt.) G.L.Merr.

This species prefers soil and needle litter and is fairly common from the *Abies* zone up into the subalpine areas of the study area. Sterile plants can resemble *Polytrichum juniperinum* Hedw., but the asymmetric capsules separate them immediately.

Specimens cited. **RW**: trail to Little Duck Lake above junction with trail to Big Duck Lake, 3 Jul 2020, 6500 ft, *Shevock & Magnaghi 56963*; Pacific Crest Trail just S of Paynes Lake, 1 Aug 2020, 6540 ft, *Shevock & Brooks 57171*; between Albert and Upper Albert Lake, 1 Aug 2020, 7065 ft, *Brooks & Shevock*

4066 (CAS); above Albert Lake, 14 Aug 2020, 6940 ft, *Shevock 57263* slope between Waterdog Lake and Russian Lake, 29 Aug 2020, 7000 ft, *Shevock & Magnaghi 57398*; S end of Taylor Lake, 15 Oct 2020, 6650 ft, *Shevock 57655*.

Metaneckera menziesii (Drumm.) Steere

This is a large and distinctive moss, due primarily to the rust-orange coloration of the older stems and rounded leaves, when dry, are strongly wavy. It generally forms large masses on tree trunks or on vertical rock walls. In the project area, it is restricted to riparian corridors with ample humidity.

Specimens cited. **LS**: county road 1C02 at Sixmile Creek, 17 Oct 2019, 3995 ft, *Shevock & Liu 55463*; Shadow Creek off of county road 1C02, 13 Jun 2020, 2870 ft, *Shevock 56786*; forest highway 39, 0.6 mi from junction with county road 1C02, 27 Oct 2020, 4130 ft, *Shevock 57869*; county road 1C01, 4.7 mi W of Etna Summit paralleling North Fork Russian Creek near confluence with Taylor Creek, 2 Dec 2020, 3490 ft, *Shevock 57924*; confluence of North Russian and South Russian Creeks, 25 Feb 2021, 2665 ft, *Shevock 57989*.

Mnium thomsonii Schimp.

The upper leaf cells of this moss lack corner thickenings.

Specimens cited. **LS**: county road 1C01 at Mill Creek 5 mi SW of Etna, 27 Aug 2020, 3950 ft, *Shevock 57310, 57324*; Meeks Meadow Creek above Meeks Meadow Lake, 16 Oct 2020, 6225 ft, *Shevock 57713*; **RW**: slope above Sugar Lake, 6 Oct 2012, 6975 ft, *Shevock & Kellman 41166* and *Kellman & Shevock 6931, 6979* (CAS); above Albert Lake toward Upper Albert Lake, 1 Aug 2020, 6900 ft, *Shevock & Brooks 57178*; South Russian Creek Trail between wilderness boundary and switchbacks, 3 Oct 2020, 5300 ft, *Shevock & York 57531*; Sugar Creek about 0.5 mi above forest road 41N14, 28 Oct 2020, 4840 ft, *Shevock 57876*.

Neckera douglasii Hook.

Although this moss is common along the coastal mountains, farther inland it is usually in small populations in shaded canyons associated with Pacific Yew (*Taxus brevifolia*). Contrasted with *Metaneckera menziesii*, the plants are pale green, have more acuminate leaves lacking a costa and an apex with dentate teeth.

Specimen cited. **LS**: along county road 1C01, about 18 mi W of Etna, 18 May 1972, 2800 ft, *Norris & Hermann 22755* (UC).

Oncophorus virens (Hedw.) Brid.

This attractive moss mostly grows along streams on rotten wood. Its strumose capsules help to identify it in the field.

Specimens cited. **LS**: Upper Ruffey Lake, 22 Jul 2006, 6615 ft, *Lenz 3102, 3107, 3108* (CAS) and 16 Oct 2020, 6600 ft, *Shevock 57674*; **RW**: Waterdog Lake, 15 Sep 1973, 7000 ft, *McGrew 0477, 0493, 0494* (UC); below outlet of Upper Albert Lake, 14 Aug

2020, 7000 ft, *Shevock* 57257; Pacific Crest Trail at junction to Statue Lake, 2 Oct 2020, 6925 ft, *Shevock & York* 57473.

Orthodicranum tauricum (Sapjegin) Smirnova

This is a very common and widespread species that especially prefers the base of coniferous trees and rotten logs. It is rarely found on vertical rock walls along streams. The deep emerald-green coloration of the plants, coupled with leaf tips that are easily broken off aiding in its dispersal, are diagnostic field characters.

Specimens cited. **LS**: forest road 41N16 at crossing of Little Jackson Creek, 1.2 mi from junction with county road 1C02, 30 Jul 2020, 5200 ft, *Shevock* 57110; trail between Upper Ruffey Lake and Meeks Meadow Lake, 16 Oct 2020, 6440 ft, *Shevock* 57702; county road 1C01, 4.7 mi W of Etna Summit paralleling North Fork Russian Creek near confluence with Taylor Creek, 2 Dec 2020, 3490 ft, *Shevock* 57930; **RW**: trail to Sugar Lake, 20 Jun 2012, 4680 ft, *Shevock* 40377 and 6 Oct 2012, 1560 m, *Kellman & Shevock* 6905 (CAS); trail toward Big Duck Lake and Little Duck Lake, 3 Jul 2020, 6000 ft, *Shevock & Magnaghi* 56971; Paynes Lake Trail about 0.5 mi below junction with the Pacific Crest Trail, 14 Aug 2020, 5975 ft, *Shevock* 57238; trail between Taylor Lake and Hogan Lake, 28 Aug 2020, 5935 ft, *Shevock & Magnaghi* 57369; South Russian Creek Trail at the switchbacks, 3 Oct 2020, 5570 ft, *Shevock & York* 57539; Eaton Lake Trail near junction with Duck Lake Trail, 17 Oct 2020, 5675 ft, *Shevock* 57723.

Orthotrichum alpestre Hornsch.

Examination of the stomatal position must be done to avoid confusion with several *Lewinskya* species in the area. All *Orthotrichum* species have immersed (cryptoporous) stomatas, whereas *Lewinskya* species have superficial (phaneroporpus) ones. In the study area, this medium-sized species occurs on rock.

Specimen cited. **RW**: Paynes Lake Trail just above crossing of Paynes Lake Creek about 0.5 mi below junction with the Pacific Crest Trail, 14 Aug 2020, 6000 ft, *Shevock* 57246.

Orthotrichum confusum R.Medina, F.Lara & Garilleti

This recently described species (Medina et al. 2012) is another member of the *Orthotrichum consimile* Mitt., complex. Microscopically, the leaf apex often has a filiform to unguiculate acumen. The type locality is near Seiad Valley, Siskiyou County.

Specimens cited. **LS**: Russian Creek below crossing of forest road 40N54 near confluence with North Fork Salmon River, 16 Oct 2020, 2580 ft, *Shevock* 57660; Shadow Creek off of county road 1C02, 27 Oct 2020, 3270 ft, *Shevock* 57831 and 8 Apr 2021, *Shevock* 58317; county road 1C01, 4.7 mi W of Etna Summit paralleling North Fork Russian Creek near confluence with Taylor Creek, 2 Dec 2020, 3490 ft, *Shevock* 57922; Whites Gulch Creek along forest

road 40N61, 0.5 mi from county road 1C01, 2 Dec 2020, 2500 ft, *Shevock* 57952; South Russian Creek just above confluence with North Russian Creek, 25 Feb 2021, 2665 ft, *Shevock* 57988.

Orthotrichum consimile Mitt.

This is a very small species that prefers fine diameter hardwood twigs (usually *Acer macrophyllum* or *Philadelphus lewisii*) in relatively humid areas usually along streams. Due to its small size, it can easily be overlooked.

Specimen cited. **LS**: forest road 40N54 above bridge crossing of Russian Creek, 16 Aug 2020, 3035 ft, *Shevock* 57294.

Orthotrichum hallii Sull. & Lesq.

The blunt leaf apices and bistratose lamina are diagnostic features of this moss.

Specimen cited. **RW**: NW slope above Hogan Lake, 28 Aug 2020, 5960 ft, *Shevock & Magnaghi* 67380.

Orthotrichum rivulare Turner

This is a species exclusively occurring in riparian areas throughout California as a rheophyte where plants are either seasonally submerged or in the splash zone. Plants are usually on rock, but it can also colonize exposed roots or tree trunks along streams. It appears to be very rare in the study area, although common in lower elevations of the Salmon River and tributaries.

Specimen cited. **LS**: county road 1C02 along North Russian Creek, 2 mi above North Fork Salmon River Bridge, 16 Aug 2020, 3035 ft, *Shevock* 57290a.

Philonotis americana Dism.

In *Flora of North America North of Mexico* (Flora of North America Editorial Committee 2014), Griffin treated this taxon as a variety of *Philonotis fontana* (Hedw.) Brid. We prefer to recognize this moss at the species level. It is distinctive in its large size with upper leaves spiraled around the stem.

Specimens cited. **LS**: county road 1C01, 1 mi W of Etna Summit, 21 Jun 2020, 5325 ft, *Shevock* 56911; S end of Upper Ruffey Lake, 16 Oct 2020, 6600 ft, *Shevock* 57672.

Philonotis capillaris Lindb.

This delicate-looking *Philonotis* Brid., grows as loose tufts or sprawling shoots over damp to moist soil. The specimens from the study area are mostly sterile.

Specimens cited. **LS**: hillside spring along county road 1C01, 0.3 mi E of Etna Summit, 1 Oct 2020, 5940 ft, *Shevock* 57439; forest road 39N20, 2 mi above junction with county road 1C02, 27 Oct 2020, 3725 ft, *Shevock* 57841; county road 1C01, 3.2 mi W of Etna Summit just below Jumpoff Joe Curve, 2 Dec 2020, 4125 ft, *Shevock* 57906.

Philonotis fontana (Hedw.) Brid.

This is a widespread species that is especially common about springs and seeps where it forms large yellowish mats and it is also common in fens and lake shore margins. Sporophytes are occasional.

Specimens cited. **LS**: Pacific Crest Trail about 3 mi S of Etna Summit above Smith Lake, 8 Jul 2003, 2200 m, *Norris & Hillyard 105769* (UC); county road 1C02, 9.5 mi S of Callahan and 2.2 mi below Carter Meadows Summit, 2 Jul 2020, 5160 ft, *Shevock 56918*; trail between Deacon Lee Trailhead and Waterdog Lake, 29 Aug 2020, 6890 ft, *Shevock & Magnaghi 57394*; hillside spring along county road 1C01, 0.3 mi E of Etna Summit, 1 Oct 2020, 5940 ft, *Shevock 57440*; Music Creek Trailhead at end of forest road 40N54, 2 Oct 2020, 6125 ft, *Shevock & York 57508*; North Fork of Salmon River just above junction with forest road 40N61, 4 Oct 2020, 2380 ft, *Shevock 57611*; **RW**: outlet of Taylor Lake, 2 Aug 2020, 6400 ft, *Shevock & Brooks 57209*; Paynes Lake Trail at crossing of Paynes Lake Creek, 14 Aug 2020, 5975 ft, *Shevock 57234*; fen below outlet of Russian Lake, 29 Aug 2020, 7020 ft, *Shevock & Magnaghi 57401*; fen at headwaters of South Russian Creek, 3 Oct 2020, 6115 ft, *Shevock & York 57556*; S end of Taylor Lake, 4 Oct 2020, 6465 ft, *Shevock 57457*.

***Philonotis pumila* Kindb.**

This taxon was also similarly treated by Griffin (Flora of North America Editorial Committee 2014) as a variety of *Philonotis fontana*. It is a small plant that grows in dense sods with copious tomentum.

Specimens cited. **RW**: Russian Lake, 9 Sep 1973, 7000 ft, *McGrew 0369* (UC); SW side of Bingham Lake, 31 Jul 2020, 7200 ft, *Shevock 57146*; trail to Little Duck Lake above trail junction to Big Duck Lake, 3 Jul 2020, 6500 ft, *Shevock & Magnaghi 56959*; steep slope above Statue Lake, 2 Oct 2020, 7200 ft, *Shevock & York 57489*.

***Philonotis* sp. 1**

This is a fen species that resembles a very small species of *Breutelia* (Bruch & Schimp.) Schimp., a genus not known to occur in California. It was first discovered on the Plumas National Forest and was referenced in Dillingham (2015). Although *Philonotis* is a relatively large and taxonomically difficult genus with over 170 recognized species (Crosby et al. 2000), we view this plant most likely as undescribed. We sent a duplicate of the Russian Wilderness collection to Soledad Jiménez who has done monographic study on the genus *Philonotis* for her opinion. She states that she does not recognize this plant (Jiménez, Instituto de Botánica del Nordeste, personal communication). We also sent a duplicate to Timo Koponen (H) who also has done extensive monographic work on *Philonotis*. He states that this plant is not a *Philonotis*, but rather, is a member of the genus *Breutelia* (Koponen, Herbarium, University of Helsinki, personal communication), another large genus of 94 species (Crosby et al. 2000). An investigation of this moss as a separate phylogenetic research project is underway. Preliminary molecular data obtained by Blanka Aguero suggests this species is more likely aligned with *Philonotis* (Aguero, Duke University, personal communication).

Specimens cited. **RW**: fen below outlet of Russian Lake, 29 Aug 2020, 7020 ft, *Shevock & Magnaghi 57400*; fen at S end of Taylor Lake, 15 Oct 2020, 6460 ft, *Shevock 57636*.

***Plagiomnium insigne* (Mitt.) T.J.Kop.**

This moss can be recognized by its dark green color and long arching plagiotropous shoots. It is most commonly located along shaded stream banks.

Specimens cited. **LS**: Little Jackson Creek at end of 1.3 mi spur road from county road 1C02 below Carter Meadows Summit, 13 Jun 2020, 5575 ft, *Shevock 56769*; forest road 41N16 toward Jackson Lake, 2.7 mi from junction with county road 1C02, 30 Jul 2020, 5600 ft, *Shevock 57112*; forest road 41N14 at French Creek, 2 mi N of Sugar Creek Trailhead, 14 Aug 2020, 4195 ft, *Shevock 57274*; just above Meeks Meadow Lake, 16 Oct 2020, 6375 ft, *Shevock 57706*; forest road 41N14, 0.1 mi S of Paynes Lake Trailhead along N tributary of Horse Range Creek, 18 Oct 2020, 4350 ft, *Shevock 57761*; forest road 41N14 at Wildcat Creek, 28 Oct 2020, 4960 ft, *Shevock 57896*; county road 1C01, 4.7 mi W of Etna Summit paralleling North Fork Russian Creek near confluence with Taylor Creek, 2 Dec 2020, 3490 ft, *Shevock 57926*; **RW**: above Sugar Lake, 6 Oct 2012, 5975 ft, *Shevock & Kellman 41172*; spring along Eaton Lake Trail, 17 Oct 2020, 5700 ft, *Shevock 57728*.

***Plagiomnium medium* (Bruch & Schimp.) T.J.Kop.**

This is a paler green moss which usually occurs in fens. Sporophytes are occasional.

Specimens cited. **LS**: off county road 1C02 at Shadow Creek, 23 Apr 1984, 900 m, *Norris 70554* (UC); trail between Deacon Lee Trailhead and Waterdog Lake, 29 Aug 2020, 6840 ft, *Shevock & Magnaghi 57391*; Jackson Creek above county road 1C02, 26 Oct 2020, 4500 ft, *Shevock 57795*; **RW**: trail to Sugar Lake, 20 Jun 2012, 5680 ft, *Shevock 40376* and 6 Oct 2012, 1700 m, *Kellman & Shevock 6911* (CAS); S end of Taylor Lake, 1 Oct 2020, 6465 ft, *Shevock 57447*; South Russian Creek Trail between wilderness boundary and the switchbacks, 3 Oct 2020, 5285 ft, *Shevock & York 57520*.

***Plagiomnium rostratum* (Schrad.) T.J.Kop.**

This species is rare and sterile in California. Diagnostic features include blunt-margined teeth and emarginate leaf apices.

Specimens cited. **LS**: county road 1C01, North Russian Creek, 4 mi W of Etna Summit at junction with forest road 41N19, 27 Aug 2020, 3840 ft, *Shevock 57336*; Mill Creek off county road 1C01, 5 mi SW of Etna, 15 Oct 2020, 3950 ft, *Shevock 57628*.

***Plagiomnium venustum* (Mitt.) T.J.Kop.**

In the study area, this striking moss occurs in drier sites than the other three species of this genus. When dry, the leaves are twisted and contorted in a distinctively recognizable manner. It is common on soil and litter at tree bases and over boulders in lower elevation mixed conifer forests.

Specimens cited. **LS**: county road 1C02 at Sixmile Creek, 27 Oct 2019, 3995 ft, *Shevock & Liu 55464*; county road 1C02 at Shadow Creek, 21 Jun 2020, 3300 ft, *Shevock 56882*; North Russian Creek off county road 1C01, 2 mi above North Fork Salmon River Bridge, 16 Aug 2020, 3035 ft, *Shevock 57296*; Mill Creek off of county road 1C01, 5 mi SW of Etna, 15 Oct 2020, 3950 ft, *Shevock 57624*; forest highway 39, 0.6 mi above junction with county road 1C02, 27 Oct 2020, 4130 ft, *Shevock 57868*; county road 1C01 at junction with forest road 41N22 paralleling North Fork Russian Creek above confluence with Cow Creek, 2 Dec 2020, 3260 ft, *Shevock 57942*; **RW**: W of Sugar Lake, 6 Oct 2012, 1830 m, *Kellman & Shevock 6942c, 6943* (CAS).

Plagiothecium cavifolium (Brid.) Z.Iwats.

In the study area, this species was found only once in a shaded rocky recess. The plants are scarcely complanate, more yellowish, and less glossy than *Plagiothecium denticulatum*.

Specimen cited. **RW**: Bingham Lake, 1 Sep 1974, 6500 ft, *Norris & McGrew 45677* (UC).

Plagiothecium denticulatum (Hedw.) Bruch & Schimp.

Plants of this species are dark green, shiny, and distinctly complanate. It is most often found on wet shaded humus. Microscopically, the alar area forms a decurrent group of strongly bulging cells.

Specimens cited. **LS**: Meeks Meadow Creek above Meeks Meadow Lake, 16 Oct 2020, 6375 ft, *Shevock 57708*; Mill Creek, county road 1C01, 5 mi SW of Etna, 15 Oct 2020, 3950 ft, *Shevock 57627*; **RW**: near South Sugar Lake, 31 Aug 1974, 6000 ft, *Norris & McGrew 45581* (UC); S end of Taylor Lake, 4 Jul 2006, 6500 ft, *Lenz 3021, 3033, 3034* (CAS), 1 Oct 2020, 6465 ft, *Shevock 57468* and 15 Oct 2020, *Shevock 57659*; spring along Eaton Lake Trail less than 0.5 mi from Eaton Lake, 17 Oct 2020, 6450 ft, *Shevock 57734*.

Platydictya jungermannioides (Brid.) H.A.Crum

This inconspicuous moss is undoubtedly the most diminutive of California's pleurocarpous mosses. It is usually found in shaded overhangs or cliff crevices. This species has extremely small leaves that lack a costa and sometimes produces few-celled, peg-like gemmae in the leaf axils. The minute leaves have relatively few cells and when these are viewed under the compound microscope, they appear disproportionately large. Small forms of *Amblystegium serpens* might cause confusion, but the areolation is very different.

Specimen cited. **RW**: shaded cave-like recess along Sugar Creek about 0.5 mi above forest road 41N14, 28 Oct 2020, 4950 ft, *Shevock 57890*.

Platyhypnum alpinum (Lindb.) Loeske

[*Hygrohypnum alpinum*]

This aquatic moss has broadly ovate to orbicular, ruffled leaves. Its alar cells form a rectangular group of thin-walled cells extending up the margins. The

Norris collection is the sole voucher for the Russian Wilderness and the packet is annotated as the first California locality by David Jamieson, monographer of *Hygrohypnum* Lindb., s. l.

Specimen cited. **LS**: Duck Lake Creek above forest road 41N14, 13 Oct 1972, 5500 ft, *Norris 23300* (UC).

Platyhypnum bestii (Renauld & Cardot) Ochyra

[*Hygrohypnum bestii*]

In the Russian Wilderness, this rheophyte is much less common than other species formally placed in *Hygrohypnum*. Compared with *Hygrohypnella ochracea* and has much broader leaves. *Platyhypnum bestii* is not known to produce sporophytes in California.

Specimens cited. **LS**: Paynes Creek at crossing of forest road 41N14, 2 Aug 1975, 5550 ft, *Norris & Smith 46285, 46288* (UC).

Platyhypnum molle (Hedw.) Loeske

[*Hygrohypnum molle*]

This species is generally smaller than *Platyhypnum bestii*. The best differentiating microscopic character is the length of the marginal cells from mid to lower parts. The cells of *P. molle* are about the same length from costa to margin, whereas those in *P. bestii* become much longer in several rows toward the margin.

Specimen cited. **RW**: South Sugar Lake, 31 Aug 1974, 7000 ft, *Norris & McGrew 45617* (UC).

Platyhypnum smithii (Sw.) Ochyra

[*Hygrohypnum smithii*]

This rheophyte might be confused with *Scleropodium obtusifolium* (Mitt.) Kindb., because of its julaceous shoots, but is a smaller plant with more truly orbicular leaves, shorter leaf cells, and shorter costae. Specimens cited. **RW**: slopes above Sugar Lake, 25 Jul 1980, 6200 ft, *Norris 57380* (UC); between Albert Lake and Upper Albert Lake, 1 Aug 2020, 6900 ft, *Shevock & Brooks 57179* and *Brooks & Shevock 4065* (CAS); S end of Taylor Lake, 1 Oct 2020, 6465 ft, *Shevock 57446*.

Pohlia bolanderi (Lesq.) Broth.

This medium-sized species is mostly found on dry soil in rock crevices in subalpine to alpine areas in California. Capsules are rarely produced.

Specimens cited. **RW**: Bingham Lake, 1 Sep 1974, 7000 ft, *McGrew 0633, 0652* (UC); Waterdog Lake, 8 Sep 1973, 6900 ft, *McGrew 0250* (UC); Russian Lake, 9 Sep 1973, 7000 ft, *McGrew 0368, 0382, 0408* (UC); above Sugar Lake, 6 Oct 2012, 5975 ft, *Shevock & Kellman 41173*; Pacific Crest Trail E of Paynes Lake, 1 Aug 2020, 6565 ft, *Brooks & Shevock 4051* (CAS); Pacific Crest Trail S of junction with Music Creek Trail toward Statue Lake, 2 Oct 2020, 6800 ft, *Shevock & York 57471*; Pacific Crest Trail S of junction to Statue Lake, 2 Oct 2020, 6950 ft, *Shevock & York 57497, 57501*.

Pohlia camptotrachela (Renauld & Cardot) Broth.

This species of *Pohlia* Hedw., prefers seasonally moist soil especially along rivulets and trail banks.

The clusters of gemmae with narrow leaf primordia located among the upper leaves that can be seen with a hand-lens is highly diagnostic.

Specimens cited. **LS**: hillside spring along county road 1C01, 0.3 mi E of Etna Summit, 1 Oct 2020, 5940 ft, *Shevock 57439a*; S end of Upper Ruffey Lake, 16 Oct 2020, 6600 ft, *Shevock 57669*; Jackson Creek above county road 1C02, 26 Oct 2020, 4500 ft; *Shevock 57789*; forest road 41N14 at Wildcat Creek, 28 Oct 2020, 4960 ft, *Shevock 57897*; **RW**: Russian Lake, 9 Sep 1973, 7000 ft, *McGrew 0370* (UC); Waterdog Lake, 15 Sep 1973, 7000 ft, *McGrew 0468* (UC); outlet of Hogan Lake, 28 Aug 2020, 5935 ft, *Shevock & Magnaghi 57371*.

***Pohlia cruda* (Hedw.) Lindb.**

Pohlia cruda is easy to recognize in the field. The shiny pale green leaves with pinkish stems are diagnostic. It prefers shaded moist sites.

Specimens cited. **LS**: forest road 41N16 toward Jackson Lake, 2.7 mi from junction with county road 1C02, 30 Jul 2020, 5600 ft, *Shevock 57114*; county road 1C01 at Mill Creek 5 mi SW of Etna, 27 Aug 2020, 3950 ft, *Shevock 57310a*; outlet of Upper Ruffey Lake, 16 Oct 2020, 6550 ft, *Shevock 57689*; forest road 41N14 at Wildcat Creek, 28 Oct 2020, 4960 ft, *Shevock 57898*; confluence of North Russian and South Russian Creeks, 25 Feb 2021, 2665 ft, *Shevock 57987*; **RW**: above Sugar Lake, 25 Aug 1973, 6000 ft, *McGrew 0159, 0195* (UC) and 6 Oct 2012, 5975 ft, *Shevock & Kellman 41164*; Lower Russian and Golden Russian Lake, 8 Sep 1973, 5800 ft, *McGrew 0356* (UC); Bingham Lake, 1 Sep 1974, 7000 ft, *McGrew 0621* (UC); below outlet of Taylor Lake, 2 Aug 2020, 6500 ft, *Shevock & Brooks 57208* and *Brooks & Shevock 4078* (CAS); Taylor Lake, 4 Jul 2006, 6500 ft, *Lenz 3013* (CAS); rivulets in fen at S end of Taylor Lake, 1 Oct 2020, 6465 ft, *Shevock 57461*; steep slope above Statue Lake, 2 Oct 2020, 7200 ft, *Shevock & York 57485*; South Russian Creek Trail between wilderness boundary and the switchbacks, 3 Oct 2020, 5400 ft, *Shevock 57532*; spring along Eaton Lake Trail near Eaton Lake, 17 Oct 2020, 6450 ft, *Shevock 57735*.

***Pohlia drummondii* (Müll.Hal.) A.L.Andrews**

Plants of this species are reddish-green and glossy. Gemmae can occur in the leaf axils, but are rare in local plants. Contrasted with those of *P. camptotrachela*, they are larger and have leaf-like primordia. Specimens cited. **RW**: Sugar Creek, 18 Aug 1973, 5800 ft, *McGrew 0085* (UC) and 25 Aug 1973, 6100 ft, *McGrew 0203, 0204* (UC); below outlet of Upper Albert Lake, 14 Aug 2020, 7000 ft, *Shevock 57258* [det. by Jon Shaw]; trail between Taylor Lake and Hogan Lake at ridge above Taylor Lake, 28 Aug 2020, 6870 ft, *Shevock & Magnaghi 57385*.

***Pohlia nutans* (Hedw.) Lindb.**

This is a widespread species primarily on soil and needle litter frequently at the base of trees, banks of streamlets, and edges of fens. The copper-colored

seta is usually a good diagnostic feature. However, when sterile, this species can be confused with species of *Ptychostomum*, but the serrate leaf margins, longer leaf cells and paroicous sexual condition distinguish it.

Specimens cited. **LS**: E side of Upper Ruffey Lake, 16 Oct 2020, 6600 ft, *Shevock 57682, 57683*; Meeks Meadow Creek above Meeks Meadow Lake, 16 Oct 2020, 6375 ft, *Shevock 57707*; **RW**: head of Sugar Lake, 18 Aug 1973, 5900 ft, *McGrew 0002, 0004* (UC); Sugar Creek, 18 Aug 1973, 5800 ft, *McGrew 0069* (UC); above Sugar Lake, 25 Aug 1973, 6100 ft, *McGrew 0208* (UC) and 6 Oct 2012, 5975 ft, *Shevock & Kellman 41163*; Waterdog Lake, 8 Sep 1973, 7000 ft, *McGrew 0222* (UC) and 15 Sep 1973, 7000 ft, *McGrew 0527* (UC); Russian Lake, 9 Sep 1973, 7000 ft, *McGrew 0559* (UC); Bingham Lake, 1 Sep 1974, 7000 ft, *McGrew 0650, 0654* (UC); outlet of Little Duck Lake, 3 Jul 2020, 6550 ft, *Shevock & Magnaghi 56935*; trail to Little Duck Lake above junction with Big Duck Lake, 3 Jul 2020, 6500 ft, *Shevock & Magnaghi 56965*; outlet of Bingham Lake, 31 Jul 2020, 7000 ft, *Shevock 57144*; Paynes Lake Trail below junction with the Pacific Crest Trail, 14 Aug 2020, 6200 ft, *Shevock 57248*; trail between Taylor Lake and Hogan Lake, 28 Aug 2020, 6030 ft, *Shevock & Magnaghi 57365*.

***Pohlia wahlenbergii* (F.Weber & D.Mohr) A.L.Andrews**

Plants of this pale, whitish-green species vary greatly in size. Sporophytes are unknown in the study area. This species prefers moist to wet soil.

Specimens cited. **LS**: county road 1C01, 3.4 mi W of Etna Summit at spring just below Jumpoff Joe Curve, 27 Aug 2020, 4115 ft, *Shevock 57330*; forest road 41N14, 0.1 mi S of Paynes Lake Trailhead, N tributary of Horse Range Creek, 18 Oct 2020, 4350 ft, *Shevock 57767*; Jackson Creek above county road 1C02, 26 Oct 2020, 4500 ft, *Shevock 57785*; dripping vertical wall of Cow Creek just above county road 1C01 at junction with forest road 40N22, 2 Dec 2020, 3260 ft, *Shevock 57936*; forest road 40N61, 0.8 mi from junction with county road 1C01 and North Fork Salmon River, 25 Mar 2021, 2300 ft, *Shevock 58164*; **RW**: S end Taylor Lake, 4 Jul 2006, 6500 ft, *Lenz 3050* (CAS); between Albert Lake and Upper Albert Lake, 1 Aug 2020, 6900 ft, *Shevock & Brooks 57183*.

***Polytrichastrum alpinum* (Hedw.) G.L.Sm.**

This species and the following have toothed upper leaf margins. It is necessary to cross-section the leaves to observe the morphology of the terminal cell of the lamellae; this will separate this species from *Polytrichum commune* Hedw.

Specimens cited. **LS**: Meeks Meadow Creek above Meeks Meadow Lake, 16 Oct 2020, 6375 ft, *Shevock 57704*; **RW**: W of Sugar Lake, 6 Oct 2012, 1815 m, *Kellman & Shevock 6922a* (CAS); slope above Bingham Lake, 31 Jul 2020, 7250 ft, *Shevock 57132*; between Albert Lake and Upper Albert Lake,

1 Aug 2020, 6900 ft, *Shevock & Brooks* 57185; trail between Taylor Lake and Hogan Lake, 28 Aug 2020, 6030 ft, *Shevock & Magnaghi* 57359; S end of Taylor Lake, 1 Oct 2020, 6465 ft, *Shevock* 57449; South Russian Creek Trail between wilderness boundary and the switchbacks, 3 Oct 2020, 5300 ft, *Shevock & York* 57533.

Polytrichum commune Hedw.

This widespread species is usually taller than the previous entry and grows on wetter soils.

Specimens cited. **RW**: just below outlet of Sugar Lake, 20 Jun 2012, 5935 ft, *Shevock* 40387 and above Sugar Lake, 6 Oct 2012, 5975 ft, *Shevock & Kellman* 41167 and at Sugar Lake, 1810 m, *Kellman & Shevock* 6913 (CAS); outlet of Little Duck Lake, 3 Jul 2020, 6550 ft, *Shevock & Magnaghi* 56931; banks of Waterdog Lake, 29 Aug 2020, 7000 ft, *Shevock & Magnaghi* 57396.

Polytrichum juniperinum Hedw.

This is a widespread species, but unless plants are with capsules it is less frequently collected. In the study area, it occupies much of the same habitats as *Meiotrichum lyallii*. The marginal leaf lamina are inflexed and overlap the lamellae, appearing as two hyaline membranes on the adaxial surface. This can be seen with a hand-lens on moist plants in strong light.

Specimens cited. **RW**: outlet of Hogan Lake, 28 Aug 2020, 5835 ft, *Shevock & Magnaghi* 57370; steep slopes above Statue Lake, 2 Oct 2020, 7200 ft, *Shevock & York* 57490.

Polytrichum piliferum Hedw.

This is a widespread species in California in dry rocky areas in full sun. This moss is easily separated from *Polytrichum juniperinum* by the long, hyaline awns on the leaves. It appears to be quite rare in the study area.

Specimens cited. **LS**: county road 1C01, 0.9 mi NE of junction with forest road 40N61 and about 1.5 mi SW of Idlewild Campground and bridge crossing of North Fork Salmon River, 2 Dec 2020, 2550 ft, *Shevock* 57956; county road 1C02, 0.5 mi NE of Shadow Creek, 8 Apr 2021, 3000 ft, *Shevock* 58315; **RW**: Bingham Lake, 1 Sep 1974, 6500 ft, *Norris & McGrew* 45674 (UC); Paynes Lake, 2 Aug 1975, 6000 ft, *Norris & Smith* 46378 (UC).

Pseudobraunia californica (Lesq.) Broth.

This species prefers boulders in sun at the lowest elevations of the study area. The plants form thin mats and when dry have a bronze hue and the leaves have white wavy hairpoints and the frequently produced capsules lacks a peristome.

Specimens cited. **LS**: forest road 40N54 just beyond bridge crossing of Russian Creek, 27 Aug 2020, 2580 ft, *Shevock* 57347; North Fork Salmon River at junction with forest road 40N61, 4 Oct 2020, 2380 ft, *Shevock* 57608; forest highway 39, 0.6 mi above junction with county road 1C02, 27 Oct 2020, 4130 ft, *Shevock* 57863.

Pseudoleskea incurvata Hedw.

[*Lescuraea incurvata*]

Compared with *P. radicata* Mitt., the apical leaf cells are shorter.

Specimens cited. **RW**: W of Sugar Lake, 6 Oct 2012, 1835 m, *Kellman & Shevock* 6907, 6909, 6946 (CAS); trail toward Big Duck and Little Duck Lake, 3 Jul 2020, 5800 ft, *Shevock & Magnaghi* 56973; trail between Taylor Lake and Hogan Lake, 28 Aug 2020, 6030 ft, *Shevock & Magnaghi* 57361, 57368; S end of Taylor Lake, 1 Oct 2020, 6465 ft, *Shevock* 57365; South Russian Creek Trail at the wilderness boundary, 3 Oct 2020, 5195 ft, *Shevock & York* 57512.

Pseudoleskea patens Lindb.

[*Lescuraea patens*]

This species of *Pseudoleskea* Schimp., is common throughout the study area, occurring as thin mats over boulders. Plants are generally darker green and are more finely textured than other species of this genus. Microscopically, there is one large papilla on each leaf cell.

Specimens cited. **LS**: Upper Ruffey Lake, 22 Jul 2006, 6615 ft, *Lenz* 3104, 3106 (CAS); forest road 41N16 toward Jackson Lake, 2.7 mi from junction of county road 1C02, 30 Jul 2020, 5600 ft, *Shevock* 57116; trail between Upper Ruffey Lake and Meeks Meadow Lake, 16 Oct 2020, 6440 ft, *Shevock* 57701; **RW**: outlet of Sugar Lake, 20 Jun 2012, 5935 ft, *Shevock* 40400; trail to Little Duck Lake above junction with trail to Big Duck Lake, 3 Jul 2020, 6500 ft, *Shevock & Magnaghi* 56964; slopes above Bingham Lake, 31 Jul 2020, 7250 ft, *Shevock* 57124; Pacific Crest Trail S of Paynes Lake, 1 Aug 2020, 6540 ft, *Shevock & Brooks* 57169; below outlet of Taylor Lake, 2 Aug 2020, 6400 ft, *Shevock & Brooks* 57203; just above Albert Lake, 14 Aug 2020, 6940 ft, *Shevock* 57262; below outlet of Russian Lake, 29 Aug 2020, 7020 ft, *Shevock & Magnaghi* 57408; steep slopes above Statue Lake, 2 Oct 2020, 7200 ft, *Shevock & York* 57483.

Pseudoleskea radicata Mitt.

[*Lescuraea radicata*]

This species of *Pseudoleskea* is also very common on boulders and rock walls. Plants form thick mats of a lighter green coloration compared to *Pseudoleskea patens*. Leaves are slightly curved away from the stem and their apical cells are rather long. Sporophytes are rare.

Specimens cited. **LS**: Little Jackson Creek at end of 1.3 mi spur road from county road 1C02 below Carter Meadows Summit, 13 Jun 2020, 5575 ft, *Shevock* 56767; **RW**: trail to Sugar Lake, 20 Jun 2012, 5800 ft, *Shevock* 40385 and 6 Oct 2012, 5500 ft, *Shevock & Kellman* 41157 and *Kellman & Shevock* 6908 (CAS); trail to Little Duck Lake above junction to Big Duck Lake, 3 Jul 2020, 6500 ft, *Shevock & Magnaghi* 56970; below outlet of Taylor Lake, 2 Aug 2020, 6400 ft, *Shevock & Brooks* 57200; Paynes Lake Trail at Paynes Lake Creek, 14 Aug 2020, 5975 ft, *Shevock* 57233; Pacific Crest Trail S of junction to

Statue Lake, 2 Oct 2020, 6925 ft, *Shevock & York* 57498; slope S of Taylor Lake, 15 Oct 2020, 6650 ft, *Shevock* 57646; Eaton Lake Trail, 17 Oct 2020, 5700 ft, *Shevock* 57730 and at 5830 ft, *Shevock* 57733.

***Pseudoleskea saviana* DeNot.**

[*Lescuraea saviana*]

A microscopic mount of several leaves shows the distinctive abruptly narrowed acumen.

Specimens cited. **LS**: county road 1C01 at Mill Creek 5 mi SW of Etna, 21 Jun 2020, 3950 ft, *Shevock* 56917 and 27 Aug 2020, 3950 ft, *Shevock* 57314; forest road 40N54, at Russian Creek near junction with county road 1C01, 21 Jun 2020, 2695 ft, *Shevock* 56905; South Russian Creek Trail about 1 mi from trailhead, 30 Aug 2020, 4800 ft, *Shevock & Magnaghi* 57428; Jackson Creek above county road 1C02, 26 Oct 2020, 4500 ft, *Shevock* 57796; county road 1C01, 4.7 mi W of Etna Summit paralleling North Fork Russian Creek, 2 Dec 2020, 3490 ft, *Shevock* 57913; **RW**: S side of Little Duck Lake, 3 Jul 2020, 6600 ft, *Shevock & Magnaghi* 56949; South Russian Creek Trail between wilderness boundary and the switchbacks, 3 Oct 2020, 5300 ft, *Shevock & York* 57530.

***Pseudoleskea stenophylla* Renaud & Cardot**

[*Lescuraea stenophylla*]

This is a small-statured member of the genus recognized by its relatively narrow, slenderly long acuminate leaves. Specimens from the study area lack sporophytes.

Specimens cited. **RW**: S end of Taylor Lake, 4 Jul 2006, 6500 ft, *Lenz* 3036 (CAS) and 15 Oct 2020, 6650 ft, *Shevock* 57648; E slope above Eaton Lake, 17 Oct 2020, 6625 ft, *Shevock* 57748.

***Pseudotaxiphyllum elegans* (Brid.) Z.Iwats.**

Filamentous propagula with reduced leaves can form clusters in the leaf axils, but these are often sparingly produced in local plants. Sporophytes are unknown in the study area.

Specimens cited. **RW**: S side of Little Duck Lake, 3 Jul 2020, 6600 ft, *Shevock & Magnaghi* 56945; SW slope of Bingham Lake, 31 Jul 2020, 7200 ft, *Shevock* 57148.

***Pterigynandrum filiforme* Hedw.**

This moss is so distinctive that it cannot be confused with any other species in the study area. The leaves are exceedingly small and tightly appressed along the shoots. Although it can occur on bark, this species is much more common on boulders where it forms large, dense mats. The populations on granitic rocks along South Russian Creek Trail are impressive. Microscopically, the leaf cells are prorulose and small gemmae are sometimes present.

Specimens cited. **LS**: county road 1C01 at Mill Creek 5 mi SW of Etna, 27 Aug 2020, 3950 ft, *Shevock* 57318; South Russian Creek Trail about 1 mi from the trailhead, 30 Aug 2020, 4690 ft, *Shevock & Magnaghi* 57423; Jackson Creek above county road 1C02, 26 Oct 2020, 4500 ft, *Shevock* 57798; Trail Creek above forest road 39N06, 26 Oct 2020, 4850 ft,

Shevock 57804; forest highway 39, 0.6 mi above junction with county road 1C02, 27 Oct 2020, 4130 ft, *Shevock* 57866; **RW**: trail to Sugar Lake, 20 Jun 2012, 4680 ft, *Shevock* 40379 and 6 Oct 2012, 1560 m, *Kellman & Shevock* 6904 (CAS); slope above N side of Hogan Lake, 28 Aug 2020, 5960 ft, *Shevock & Magnaghi* 57379; Sugar Creek about 0.5 mi above forest road 41N14, 28 Oct 2020, 4840 ft, *Shevock* 57873a and at 4920 ft, *Shevock* 57892.

***Ptychomitrium gardneri* Lesq.**

This is the only member of this genus in California. Plants are easy to recognize due to the multiple sporophytes per shoot having mitrate calyptrae.

Specimens cited. **LS**: county road 1C02 at Sixmile Creek, 27 Oct 2019, 3995 ft, *Shevock & Liu* 55470; forest road 40N54 at South Russian Creek Bridge, 3.8 mi from junction with county road 1C01, 31 Jul 2020, 4150 ft, *Shevock* 57163, county road 1C01, North Russian Creek, 16 Aug 2020, 3035 ft, *Shevock* 57305.; North Fork Salmon River just above bridge crossing of forest road 40N61, 4 Oct 2020, 2380 ft, *Shevock* 57599, 57601.

***Ptychostomum creberrimum* (Taylor) J.R.Spence & H.P.Ramsay**

[*Bryum creberrimum*]

This common species forms dense tufts of comose shoots and the costae are excurrent.

Specimens cited. **LS**: near Jackson Lake, 12 Jun 1972, *Norris* 22911 (UC); forest road 41N14 at Paynes Creek, 2 Aug 1975, 5500 ft, *Norris & Smith* 46273 (UC); North Fork Salmon River above bridge crossing of forest road 40N61, 4 Oct 2020, 2380 ft, *Shevock* 57512; below outlet of Upper Ruffey Lake, 16 Oct 2020, 6550 ft, *Shevock* 57694; **RW**: near South Sugar Lake, 31 Aug 1974, 6000 ft, *Norris & McGrew* 45628 (UC); outlet of Sugar Lake, 20 Jun 2012, 5935 ft, *Shevock* 40393; W side of Little Duck Lake, 3 Jul 2020, 6685 ft, *Shevock & Magnaghi* 56954; at junction of Duck Lake Trail with the Eaton Lake Trail, 17 Oct 2020, 5675 ft, *Shevock* 57759

***Ptychostomum pacificum* J.R.Spence & Shevock**

This robust species is rare in the study area. When first described by Spence and Shevock (2012), it was primarily known to occur in the Sierra Nevada, Cascades, and North Coast Ranges. It is here reported for the Klamath Ranges. Perennially wet fens are its preferred habitat and the plants rarely produce sporophytes.

Specimens cited. **RW**: Big Duck Lake, 12 Jun 1972, 6500 ft, *Norris* 22902 (UC); fen above Albert Lake, 1 Aug 2020, 6940 ft, *Brooks & Shevock* 4069 (CAS) and 14 Aug 2020, 6940 ft, *Shevock* 57260; in saturated fen at S end of Taylor Lake, 4 Jul 2006, 6500 ft, *Lenz* 3044, 3045 (CAS) and 1 Oct 2020, 6465 ft, *Shevock* 57459.

***Ptychostomum pallescens* (Schleich. ex Schwägr.) J.R.Spence**

[*Bryum pallescens*]

According to Spence (California Academy of Sciences, personal communication), the collections attributed to be this taxon from the study area are all strange forms of *P. pallescens* that are larger in size than is normally encountered in this species. However, the spore size matches this species.

Specimens cited. **LS**: Upper Ruffey Lake just below outlet in steep canyon, 16 Oct 2020, 6550 ft, *Shevock* 57684; Jackson Creek with hillside spring above county road 1C02, 6.7 mi W of Callahan, 26 Oct 2020, 4500 ft, *Shevock* 57787; **RW**: NE shore of Bingham Lake, 31 Jul 2020, 7050 ft, *Shevock* 57140.

Ptychostomum pseudotriquetrum (Hedw.) J.R.Spence & H.P.Ramsay ex Holyoak & N.Pedersen

[*Bryum pseudotriquetrum*]

This is among the most variable mosses imaginable. Several ecological forms exist that correlate to the amount of water available coupled with the diversity of habitats from rivulets, streams, springs, and fens. Species identification, therefore, usually requires a microscopic examination. Sporophytes are uncommon.

Specimens cited. **LS**: Duck Lakes Trail just above forest road 14N14, 11 Jun 1972, 5500 ft, *Norris* 22828 (UC); trail between Deacon Lee Trailhead to Waterdog Lake, 29 Aug 2020, 6540 ft, *Shevock & Magnaghi* 57388; Jackson Creek above county road 1C02, 26 Oct 2020, 4500 ft, *Shevock* 57794; forest road 40N54, 1 mi from junction with county road 1C01, 25 Mar 2021, 2990 ft, *Shevock* 58159; **RW**: above Sugar Lake, 25 Aug 1973, 6100 ft, *McGrew* 0210 (UC); below outlet of Sugar Creek, 20 Jun 2012, 5935 ft, *Shevock* 40393; S side of Hogan Lake, 28 Aug 2020, 5935 ft, *Shevock & Magnaghi* 57375; fen at headwaters of South Russian Creek, 3 Oct 2020, 6115 ft, *Shevock & York* 57553; S end of Taylor Lake, 15 Oct 2020, 6465 ft, *Shevock* 57635; Sugar Creek about 0.5 mi above forest road 41N14, 28 Oct 2020, 4840 ft, *Shevock* 57880.

Ptychostomum turbinatum (Hedw.) J.R.Spence

[*Bryum turbinatum*]

Usually a moss of fen habitats, it is recognized by its turbinate to short-pyriform capsules.

Specimen cited. **LS**: county road 1C02 at switchbacks, 9.5 mi W of Callahan and 2.2 mi below Carter Meadows Summit, 2 Jul 2020, 5100 ft, *Shevock* 56919.

Ptychostomum weigeli (Spreng.) J.R.Spence

[*Bryum weigeli*]

This species is generally restricted to fens with saturated humus usually among *Veratrum* L. Early in the growing season shortly after snowmelt, the plants, when in the sun, can have a pinkish hue.

Specimens cited. **RW**: above Big Duck Lake, 13 Oct 1972, 6600 ft, *Norris* 23345, 23347 (UC); S side of Sugar Lake, 20 Jun 2012, 5950 ft, *Shevock* 40407 and W of Sugar Lake, 6 Oct 2012, 1810 m, *Kellman & Shevock* 6924 (CAS); S end of Taylor Lake, 1 Oct 2020, 6465 ft, *Shevock* 57451; Eaton Lake Trail near

junction with Duck Lake Trail, 17 Oct 2020, 5700 ft, *Shevock* 57729.

Pulviger a howei (Renauld & Cardot) F.Lara, Draper & Garilleti

This taxon is part of the *Orthotrichum lyellii* Hook. & Taylor complex. The genus *Pulviger a* Plášek, Sawicki & Ochrya was established by Plášek et al. (2015) and *O. lyellii* was transferred as the type species for this new genus. Two species long placed as synonyms of *O. lyellii* have been shown to be molecularly and morphologically distinct, and therefore, have recently been elevated and transferred into this genus. See Lara et al. (2020) for species descriptions and illustrations. *Pulviger a howei* is fairly widespread in the project area, especially in lower elevations. This species prefers hardwood trunks and branches and most frequently encountered along riparian corridors.

Specimens cited. **LS**: county road 1C02 at Sixmile Creek, 18 May 1972, 600 m, *Norris* 22964 (UC); county road 1C02 at Shadow Creek, 21 Jun 2020, 3310 ft, *Shevock* 56881; county road 1C01 at Mill Creek 5 mi SW of Etna, 31 Jul 2020, 3950 ft, *Shevock* 57153; county road 1C01 along North Russian Creek, 1.8 mi from North Fork Salmon River Bridge, 31 Jun 2020, 3590 ft, *Shevock* 57161 and 2 mi E of North Fork Salmon River, 16 Aug 2020, 3035 ft, *Shevock* 57293; forest road 40N54 at Russian Creek, 2 Aug 2020, 2580 ft, *Shevock* 57191; forest road 41N14 at French Creek, 2 mi N of Sugar Creek Trailhead, 13 Aug 2020, 4194 ft, *Shevock* 57228; South Russian Creek Trail about 1 mi from trailhead, 30 Aug 2020, 4690 ft, *Shevock & Magnaghi* 57424, forest road 40N54A near junction with road 40N54, 30 Aug 2020, 4600 ft, *Shevock* 57431; county road 1C01, 1.6 mi below the Mill Creek Bridge toward Etna, 1 Oct 2020, 3630 ft, *Shevock* 57438; trail between Upper Ruffey Lake and Meeks Meadow Lake, 16 Oct 2020, 6440 ft, *Shevock* 57703; Trail Creek below crossing of forest road 39N06, 26 Oct 2020, 4850 ft, *Shevock* 57815; Sixmile Creek above county road 1C02, 26 Oct 2020, 4025 ft, *Shevock* 57828; county road 1C01, 4.7 mi W of Etna Summit paralleling North Fork Russian Creek near confluence with Taylor Creek, 2 Dec 2020, 3490 ft, *Shevock* 57921; county road 1C01 at junction with forest road 41N22 paralleling North Fork Russian Creek above confluence with Cow Creek, 2 Dec 2020, 3260 ft, *Shevock* 57943; Whites Gulch Creek along forest road 40N61, 0.5 mi from county road 1C01, 2 Dec 2020, 2500 ft, *Shevock* 57952a; county road 1C01 at junction with forest road 40N61 above the North Fork Salmon River, 25 Feb 2021, 2470 ft, *Shevock* 57977; **RW**: trail between Taylor Lake and Hogan Lake, 28 Aug 2020, 6030 ft, *Shevock & Magnaghi* 57365.

Pulviger a papillosa (Hampe) F.Lara, Draper & Garilleti

[*Orthotrichum papillosum*]

Another member of the *Orthotrichum lyellii* complex, this plant has plane leaf margins and strongly papillose spores. This species also prefers hardwood branches. Sporophytes are frequently produced. Although earlier placed as a synonym of *Orthotrichum lyellii* by some bryologists, it was treated in Norris and Shevock (2004a) as a species worthy of recognition.

Specimens cited. **LS**: Mill Creek, county road 1C01, 5 mi SW of Etna, 15 Oct 2020, 3950 ft, *Shevock* 57632; forest road 39N20, 1 mi above junction with county road 1C02, 27 Oct 2020, 3330 ft, *Shevock* 57837; forest highway 39, 0.6 mi above junction with county road 1C02, 27 Oct 2020, 4130 ft *Shevock* 57870.

Rectithecium piliferum (Sw.) Hedenäs & Huttunen [*Plagiothecium piliferum*]

This moss forms pale-green mats with complanate to subjulaceous shoots. The leaves are abruptly contracted to a filiform, flexuose acumen. This species has long been placed in *Plagiothecium* Bruch & Schimp., however, these plants with piliferous leaves are unlike any other member of the genus. Recent phylogenetic studies (Huttunen et al. 2013) have proposed the transfer of this species into the monospecific genus, *Rectithecium* Hedenäs & Huttunen. A contrasting view is taken by Wynns et al. (2018) where he elevated this species into its own section *Rectithecium* within the genus *Plagiothecium* Bruch & Schimp. We have chosen to recognize it as a distinct genus since it does not resemble or would be viewed as a *Plagiothecium* in the field.

Specimen cited. **LS**: South Russian Creek Trail less than 0.5 mi below the wilderness boundary, 3 Oct 2020, 5000 ft, *Shevock & York* 57509.

Rhizomnium glabrescens (Kindb.) T.J.Kop.

The upper stems of this moss mostly lack rhizoids unlike *R. magnifolium* (Horik.) T.J.Kop., and *R. pseudopunctatum* (Bruch & Schimp.) T.J.Kop., which have stems heavily clothed with them. Other useful field characters are the nearly black stems bearing elliptic leaves.

Specimens cited. **RW**: above Sugar Lake, 25 Aug 1973, 6000 ft, *McGrew* 0150 (UC); South Russian Creek off of the South Russian Creek Trail between the wilderness boundary and switchbacks, 3 Oct 2020, 5300 ft, *Shevock & York* 57534.

Rhizomnium magnifolium (Horik.) T.J.Kop.

This is a showy species generally found at springs and wet areas. Only *Roellobryon roellii* (Broth.) Ochyra could possibly be confused for this moss, but *R. magnifolium* has much shorter and rounded leaf cells and lower stems with abundant reddish tomentum.

Specimens cited. **LS**: Little Jackson Creek at end of 1.3 mi spur road from county road 1C02 below Carter Meadows Summit, 13 Jun 2020, 5575 ft, *Shevock* 56770; Meeks Meadow Creek above Meeks Meadow Lake, 16 Oct 2020, 6375 ft, *Shevock* 57705; forest road 41N14, 0.1 mi S of Paynes Lake

Trailhead, tributary of Horse Range Creek, 18 Oct 2020, 4350 ft, *Shevock* 57768; **RW**: S side of Sugar Lake, 20 Jun 2012, 5950 ft, *Shevock* 40405 and above Sugar Lake, 6 Oct 2012, 5975 ft, *Shevock & Kellman* 41168 and *Kellman & Shevock* 6928, 6933 (CAS); trail below junction of Big Duck and Little Duck Lake, 3 Jul 2020, 5780 ft, *Shevock & Magnaghi* 56979; Eaton Lake Trail near junction with Duck Lake Trail, 17 Oct 2020, 5700 ft, *Shevock* 57725.

Rhizomnium pseudopunctatum (Bruch & Schimp.) T.J.Kop.

Rhizomnium pseudopunctatum is usually a fen species and differs from *R. magnifolium* in having smaller cells and unistratose, rather than bistratose, margins. Specimens cited. **RW**: Sugar Creek, 18 Aug 1973, 5800 ft, *McGrew* 0066 (UC); above Sugar Lake, 25 Aug 1973, 6000 ft, *McGrew* 0141, 0150, 0199 (UC).

Roellobryon roellii (Broth.) Ochyra

[*Roellia roellii*]

This is a very common and beautiful moss. It is most frequently encountered in subalpine areas on soil with litter and needle duff and at margins of fens and rivulets. The leaf cells are large and hexagonal and can be observed easily with a hand-lens. Capsules are cylindrical and long. The only moss genus in the study area in that could possibly be mistaken for *Roellobryon* would be members of *Rhizomnium*, although this genus within the project area occupies perennially wet areas.

Specimens cited. **LS**: Little Jackson Creek at end of 1.3 mi spur road from county road 1C02 below Carter Meadows Summit, 13 Jun 2020, 5575 ft, *Shevock* 56771; S end of Upper Ruffey Lake, 16 Oct 2020, 6600 ft, *Shevock* 57671; **RW**: above Sugar Lake, 6 Oct 2012, 1815 m, *Kellman & Shevock* 6923 (CAS); S side of Taylor Lake, 4 Jul 2006, 6500 ft, *Lenz* 3041 (CAS); S side of Sugar Lake, 20 Jun 2012, 5950 ft, *Shevock* 40404; trail to Little Duck Lake above junction of trail to Big Duck Lake, 3 Jul 2020, 6600 ft, *Shevock & Magnaghi* 56957; slopes above Bingham Lake, 31 Jul 2020, 7250 ft, *Shevock* 57126; Pacific Crest Trail just S of Paynes Lake, 1 Aug 2020, 6540 ft, *Shevock & Brooks* 57176; below outlet of Taylor Lake, 2 Aug 2020, 6400 ft, *Shevock & Brooks* 57202; just above Albert Lake, 14 Aug 2020, 6940 ft, *Shevock* 57261; trail between Taylor Lake and Hogan Lake, 28 Aug 2020, 6030 ft, *Shevock & Magnaghi* 57355; Pacific Crest Trail near junction to Statue Lake, 2 Oct 2020, 6800 ft, *Shevock & York* 57470; steep slopes above Statue Lake, 2 Oct 2020, 7300 ft, *Shevock & York* 57494.

Rosulabryum canariense (Brid.) Ochyra

[*Bryum canariense*]

This rather large species in the genus can be recognized by the stems bearing interrupted rosettes of leaves, as well as capsules that are longer than other local *Rosulabryum* J.R.Spence species. Large, red, spherical tubers are commonly present of

rhizoids. Its preferred habitat is shaded soil over rock, often mixed with other mosses.

Specimens cited. **LS**: North Fork Salmon River paralleling county road 1C01, 1.8 mi W of Idlewild Campground, 25 Feb 2021, 2480 ft, *Shevock 58002*; forest road 40N61, 1.7 mi from junction with county road 1C01 and North Fork Salmon River, 25 Mar 2021, 2600 ft, *Shevock 58167*.

Rosulabryum capillare (Hedw.) J.R.Spence

[*Bryum capillare*]

This very widespread moss is often found on shaded rock ledges. Its leaves are obovate in shape, spirally twisted when dry, and the costa is excurrent as a piliferous awn. It is a dioicous moss, and the only collections documented for the project area are without sporophytes.

Specimens cited. **LS**: North Fork Salmon River paralleling county road 1C01, 1.8 mi W of Idlewild Campground, 25 Feb 2021, 2480 ft, *Shevock 58001*; forest road 40N54, 1 mi from junction with county road 1C01, 25 Mar 2021, 2990 ft, *Shevock 58155*.

Rosulabryum elegans (Nees) Ochyra

[*Bryum elegans*]

This infrequently encountered *Rosulabryum* has a montane distribution pattern in California and occurs on bare rock surfaces rather than soil. The plants are somewhat glaucous and the leaves are broadly ovate to orbicular in shape.

Specimen cited. **RW**: steep slope above S end of Taylor Lake, 15 Oct 2020, 6650 ft, *Shevock 57647*.

Rosulabryum erythroloma (Kindb.) J.R.Spence

[*Bryum erythroloma*]

This species is similar to *R. capillare*, but differences include more reddish plants and strongly obovate leaves and a shorter awn.

Specimens cited. **LS**: Duck Lake Trail just above forest road 41N14, 11 Jun 1972, 5500 ft, *Norris 22800* (UC); county road 1C02 at Shadow Creek, 13 Jun 2020, 2850 ft, *Shevock 56795*; county road 1C01, 3.2 mi W of Etna Summit just below Jumpoff Joe Curve, 2 Dec 2020, 4125 ft, *Shevock 57909*.

Rosulabryum gemmascens (Kindb.) J.R.Spence

[*Bryum gemmascens*]

This relatively small *Rosulabryum* forms loose or dense tufts on soil or rock in dry places. It is often found with sporophytes.

Specimens cited. **LS**: North Fork Salmon River above bridge crossing of forest road 40N61, 4 Oct 2020, 2380 ft, *Shevock 57607*; Mill Creek, county road 1C01, 5 mi SW of Etna, 15 Oct 2020, 3950 ft, *Shevock 57633*; forest highway 39, 0.6 mi above junction with county road 1C02, 27 Oct 2020, 4130 ft, *Shevock 57859*; county road 1C01 at road marker 22, 0.5 mi below North Russian Creek Bridge, 25 Mar 2021, 2775 ft, *Shevock 58153*; county road 1C02, 0.5 mi NE of Shadow Creek, 8 Apr 2021, 3000 ft, *Shevock 58316*.

Rosulabryum laevifilum (Syed) Ochyra

[*Bryum laevifilum*]

This medium-sized *Rosulabryum* species has leaves that are spirally twisted around the stem when dry, a feature shared by some other species of the genus. But unique are the numerous brown filamentous and papillose gemmae borne in the upper leaf axils.

Specimens cited. **LS**: Trail Creek above county road 1C02, 26 Oct 2020, 4840 ft, *Shevock 57818*; county road 1C01, 4.7 mi W of Etna Summit paralleling North Fork Russian Creek near confluence with Taylor Creek, 2 Dec 2020, 3490 ft, *Shevock 57932*.

Sanionia uncinata (Hedw.) Loeske

This species is fairly common in the study area along springs, streams and rivulets. It can occur on both wood and rock. When well developed, this moss forms dense green to golden-yellow tufts. The leaves are long and slenderly acuminate, plicate, and falcate to circinate; all of these characters can be observed with a hand-lens. Being autoicous, sporophytes are usually present.

Specimens cited. **LS**: forest road 41N16 at crossing of Little Jackson Creek, 1.2 mi from junction with county road 1C02, 30 Jul 2020, 5200 ft, *Shevock 57106*; Meeks Meadow Creek above Meeks Meadow Lake, 16 Oct 2020, 6225 ft, *Shevock 57719*; Jackson Creek above county road 1C02, 26 Oct 2020, 4500 ft, *Shevock 57799*; **RW**: Lower Russian Lake, 8 Sep 1973, 6300 ft, *McGrew 0338* (UC); below outlet of Sugar Lake, 20 Jun 2012, 5935 ft, *Shevock 40389*, *40401*, S side of Sugar Lake, 20 Jun 2012, 5950 ft, *Shevock 40409* and 6 Oct 2012, 1810 m, *Kellman & Shevock 6918* (CAS); outlet of Little Duck Lake, 3 Jul 2020, 6550 ft, *Shevock & Magnaghi 56929*; W slope above Hogan Lake, 28 Aug 2020, 5970 ft, *Shevock & Magnaghi 57382*; South Russian Creek Trail between wilderness boundary and switchbacks, 3 Oct 2020, 5300 ft, *Shevock & York 57536*.

Sarmentypnum exannulatum (Schimp.) Hedenäs

[*Warnstorfia exannulata*]

This purplish-brown to reddish-brown moss is mostly aquatic and grows either submerged or emergent along streams, lakes or in fens. Microscopically the leaf margins are serrulate (sometimes weakly so) and the alar area is large, consisting of oblong, inflated cells. Sporophytes are lacking in the study area.

Specimens cited. **RW**: South Sugar Lake, 30 Sep 1973, 6900 ft, *McGrew 0615* (UC); S side of Little Duck Lake, 3 Jul 2020, 6550 ft, *Shevock & Magnaghi 56943*.

Schistidium agassizii Sull. & Lesq.

The linear-lanceolate leaves with plane margins serve to distinguish this from the more common *S. rivulare* (Brid.) Podp.

Specimens cited. **LS**: trail between Deacon Lee Trailhead and Waterdog Lake, 29 Aug 2020, 6540 ft, *Shevock & Magnaghi 57387*; **RW**: outlet of Bingham Lake, 31 Jul 2020, 7000 ft, *Shevock*

57143; creek below outlet of Taylor Lake, 2 Aug 2020, 6470 ft, *Brooks & Shevock 4076* (CAS).

Schistidium confertum (Funck) Bruch & Schimp.

Unlike the other *Schistidium* Bruch & Schimp., species found in the Russian Wilderness and lower slopes, *Schistidium confertum* grows in more compact cushions and has strongly differentiated perichaetial leaves. It is apparently rare in the area.

Specimen cited. **LS**: forest highway 39, 0.7 mi E of junction with forest road 39N58, 27 Oct 2020, 6025 ft, *Shevock 57847*.

Schistidium occidentale (E.Lawton) S.P.Churchill

This *Schistidium* species grows on rock in spreading mats in intermittent streams and rivulets. The leaves are variable in shape, but mostly linear-lanceolate and the costa is projecting on the abaxial surface. Another useful character is the presence of much wider, apically rounded perichaetial leaves.

Specimen cited. **LS**: W side of Upper Ruffey Lake, 16 Oct 2020, 6600 ft, *Shevock 57697*.

Schistidium rivulare (Brid.) Podp.

This rheophytic species of *Schistidium* is widespread and common from perennial streams to intermittent rivulets. It is commonly associated with *Codriophorus acicularis*. Capsules are generally present, are short-cylindric, and have reddish peristome teeth.

Specimens cited. **LS**: Upper Ruffey Lake, 22 Jul 2006, 6615 ft, *Lenz 3105, 3109* (CAS); county road 1C02 at Sixmile Creek, 27 Oct 2019, 3995 ft, *Shevock & Liu 55465*; forest road 40N54, Russian Creek near junction with county road 1C01, 21 Jun 2020, 2695 ft, *Shevock 56899*; forest road 41N16 toward Jackson Lake, 3.4 mi from junction with county road 1C02, 30 Jul 2020, 5780 ft, *Shevock 57118*; North Russian Creek along county road 1C01, 16 Aug 2020, 3035 ft, *Shevock 57290*; North Russian Creek off county road 1C01 at junction with forest road 41N19, 27 Aug 2020, 3840 ft, *Shevock 57334*; below outlet of Upper Ruffey Lake, 16 Oct 2020, 6550 ft, *Shevock 57685*, S end of Upper Ruffey Lake, 16 Oct 2020, 6600 ft, *Shevock 57670*; Meeks Meadow Creek below Meeks Meadow Lake, 16 Oct 2020, 6185 ft, *Shevock 57710*; county road 1C01 about 2.2 mi SW of Idlewild Campground and just above bridge crossing of North Fork Salmon River of forest road 40N61, 2 Dec 2020, 2550 ft, *Shevock 57948*; confluence of North Russian and South Russian Creeks, 25 Feb 2021, 2665 ft, *Shevock 57983*; **RW**: below outlet of Sugar Lake, 20 Jun 2012, 5935 ft, *Shevock 40395*; above Sugar Lake, 6 Oct 2012, 1815 m, *Kellman & Shevock 6937* (CAS); below outlet of Taylor Lake, 2 Aug 2020, 6400 ft, *Shevock & Brooks 57197, 57211* and *Brooks & Shevock 4077* (CAS); below outlet of Upper Albert Lake, 14 Aug 2020, 7095 ft, *Shevock 57254*; outlet of Hogan Lake, 28 Aug 2020, 5935 ft, *Shevock & Magnaghi 57373*; below outlet of Russian Lake, 29 Aug 2020, 7020 ft, *Shevock & Magnaghi 57411*; S end of Taylor Lake, 15 Oct 2020, 6500 ft, *Shevock 57641*.

Schistidium splendens T.T.McIntosh, H.H.Blom, D.R.Toren & Shevock

This recently described species (McIntosh et al. 2015) has long been confused in California as *S. apocarpum* (Hedw.) Bruch & Schimp., but it lacks papillae on the abaxial costal surface among other characters. It is fairly common throughout California, especially in rivulets or sheet rock drainage areas.

Specimens cited. **LS**: county road 1C02 at Jackson Creek, 23 Apr 1984, 1500 m, *Norris 70523* (UC); county road 1C01, 2 mi W of Etna Summit, 27 Aug 2020, 4930 ft, *Shevock 5738*; North Fork Salmon River above bridge crossing of forest road 40N61, 4 Oct 2020, 2380 ft, *Shevock 57603*; county road 1C02 at Sixmile Creek, 26 Oct 2020, 4025 ft, *Shevock 57819*; county road 1C01 at road marker 22, 0.5 mi below North Russian Creek Bridge, 25 Mar 2021, 2775 ft, *Shevock 58152*.

Schistidium squarrosus T.T.McIntosh, H.H.Blom, D.R.Toren & Shevock

This species can be recognized by its concave, rather than keeled, leaves and its unusually broad perichaetial leaves. See McIntosh et al. (2015) for illustrations.

Specimens cited. **LS**: Pacific Crest Trail N of Carter Meadows Summit, 15 Aug 2020, 6975 ft, *Shevock 57280*; W side of Upper Ruffey Lake, 16 Oct 2020, 6600 ft *Shevock 57698*; county road 1C02, 2.4 mi E of junction with forest highway 39 and 0.9 mi W of Trail Creek, 27 Oct 2020, 4530 ft, *Shevock 57871*.

Scleropodium cespitosus (Müll.Hal.) L.F.Koch

Typically, a smaller plant than *Scleropodium touretii* (Brid.) L.F.Koch, its leaves are quite variable in shape and lack a recurved apiculus.

Specimens cited. **LS**: county road 1C02 at Shadow Creek, 13 Jun 2020, 2870 ft, *Shevock 56788*; forest road 39N20, 1 mi above junction with county road 1C02, 27 Oct 2020, 3330 ft, *Shevock 57839*.

Scleropodium obtusifolium (Mitt.) Kindb.

This is the most widespread and common rheophytic moss in California. It occurs in a diverse suite of habitats from rivers to intermittent rivulets. Plants are commonly attached to boulders, but this species can also occur on exposed roots, tree trunks, and logs in riparian corridors where plants are seasonally submerged.

Specimens cited. **LS**: county road 1C02 at Sixmile Creek, 27 Oct 2019, 3995 ft, *Shevock & Liu 55467*; forest road 41N16 toward Jackson Lake, 3.4 mi from junction of county road 1C02, 30 Jul 2020, 5780 ft, *Shevock 57121*; forest road 41N14 at French Creek, 2 mi N of Sugar Lake Trailhead, 14 Aug 2020, 4195 ft, *Shevock 57272*; North Russian Creek along county road 1C01, 2 mi above North Fork Salmon River Bridge, 16 Aug 2020, 3035 ft, *Shevock 57307*; county road 1C02 at Shadow Creek, 21 Jun 2020, 3310 ft, *Shevock 56884*; county road 1C01, 2 mi W of Etna Summit, 27 Aug 2020, 4930 ft, *Shevock 57326*; North Russian Creek off county road 1C01, 4 mi W of Etna

Summit at junction with forest road 41N19, 27 Aug 2020, 3840 ft, *Shevock* 57333; Whites Gulch Creek off of forest road 40N61 just below junction with East Fork Whites Gulch Trail, 4 Oct 2020, 2775 ft, *Shevock* 57613; below outlet of Upper Ruffey Lake, 16 Oct 2020, 6550 ft, *Shevock* 57690; forest road 41N14, 0.3 mi S of Duck Lake Trailhead at Duck Lake Creek, 18 Oct 2020, 4300 ft, *Shevock* 57780; forest highway 39, 1.1 mi above junction with county road 1C02, 27 Oct 2020, 4530 ft, *Shevock* 57855; county road 1C01 at junction with forest road 41N22 paralleling North Fork Russian Creek above confluence with Cow Creek, 2 Dec 2020, 3260 ft, *Shevock* 57941; **RW**: trail to Sugar Lake, 20 Jun 2012, 5700 ft, *Shevock* 40415; Paynes Lake Trail at Paynes Lake Creek, 14 Aug 2020, 5975 ft, *Shevock* 57232; N slope above Hogan Lake, 28 Aug 2020, 5935 ft, *Shevock* & *Magnaghi* 57376.

***Scleropodium touretii* (Brid.) L.F.Koch**

This species somewhat resembles *Scleropodium obtusifolium*, but occurs in terrestrial rather than aquatic sites. Dry plants are recognized even in the field by the recurved apiculus of the leaves.

Specimens cited. **LS**: forest road 39N06 above Trail Creek, 26 Oct 2020, 4850 ft, *Shevock* 57800; forest road 39N20, 2 mi above junction with county road 1C02, 27 Oct 2020, 3725 ft, *Shevock* 57842; county road 1C01, 3.2 mi W of Etna Summit just below Jumpoff Joe Curve, 2 Dec 2020, 4125 ft, *Shevock* 57907; forest road 40N61, 0.1 mi from junction with county road 1C01 and North Fork Salmon River, 25 Mar 2021, 2300 ft, *Shevock* 58161; **RW**: South Russian Creek Trail at the switchbacks, 3 Oct 2020, 5570 ft, *Shevock* & *York* 57548.

***Scouleria aquatica* Hook.**

This is an infrequently encountered rheophytic species in the Russian Wilderness area, although more expansive populations occur on large boulders and rock walls among cascading sections of the North Fork Salmon River about the western border of the project area. Sporophytes are rare. Dried plants are jet-black and turn dark green instantly upon hydration. *Scouleria marginata* E.Britton can occur as mixed populations with *S. aquatica* where the species ranges overlap. In California, *S. marginata* is more commonly encountered in larger river systems than in streams and at lower elevations than is typical for *S. aquatica*. The thickened multistratose border of *S. marginata* is a diagnostic feature that can be observed with a hand-lens. Capsules are eperistomate. *Scouleria marginata* occurs in the Salmon River with populations in the South Fork above the Forks of the Salmon and is expected in the North Fork just below the project boundary.

Specimens cited. **LS**: Duck Lake Creek off forest road 41N14, 13 Oct 1972, ~5500 ft, *Norris* 23297 (UC); forest road 41N16 toward Jackson Lake in tributary stream of Jackson Creek, 3.4 mi from junction with county road 1C02, 30 Jul 2020, 5780 ft, *Shevock* 57117; North Fork Salmon River just above

junction with forest road 40N61, 4 Oct 2020, 2380 ft, *Shevock* 57605; Trail Creek above forest road 39N06, 26 Oct 2020, 4850 ft, *Shevock* 57808; **RW**: Sugar Creek above Sugar Lake, 25 Jul 1980, 4800–6000 ft, *Norris* 57349 (UC); S slope of Hogan Lake, 28 Aug 2020, 5935 ft, *Shevock* & *Magnaghi* 57374 and W slope with cascading stream above Hogan Lake, 5970 ft, 57381; South Russian Creek Trail between the wilderness boundary and the switchbacks, 3 Oct 2020, 5300 ft, *Shevock* & *York* 57524.

***Sphagnum miyabeanum* Warnst.**

[*Sphagnum subsecundum*, misapplied]

Although there are more than 20 species of *Sphagnum* L., in California (*Norris* and *Shevock* 2004a), this genus is rarely encountered within Siskiyou County due to large areas of ultramafic geology. *Sphagnum miyabeanum* is located in wet fens and lake margins in subalpine areas of granitic geology.

Specimens cited. **RW**: Sugar Lake, 6 Oct 2012, 5960 ft, *Shevock* 41160; outlet of Little Duck Lake, 3 Jul 2020, 6550 ft, *Shevock* & *Magnaghi* 56933 (det. by Jon Shaw); fen below outlet of Russian Lake, 29 Aug 2020, 7020 ft, *Shevock* & *Magnaghi* 57399 (det. by Jon Shaw); fen at headwaters of South Russian Creek, 3 Oct 2020, 6115 ft, *Shevock* & *York* 57554; Horse Range Lakes, 3 Oct 2020, 6550 ft, *York* 3369 (CAS).

***Stereodon subimponens* (Lesq.) Broth.**

[*Hypnum subimponens*]

This is a commonly encountered moss in lower elevations within the study area, especially along streams. It can form extensive golden-green mats on both boulders and the base of hardwood trees. Sporophytes are relatively common.

Specimens cited. **LS**: county road 1C02 at Sixmile Creek, 27 Oct 2019, 3995 ft, *Shevock* & *Liu* 55472; county road 1C02 at Shadow Creek, 21 Jun 2020, 3310 ft, *Shevock* 56887; forest road 40N54 at Russian Creek, 21 Jun 2020, 2695 ft, *Shevock* 56906; forest road 41N14 at French Creek, 2 mi N of Sugar Creek Trailhead, 13 Aug 2020, 4195 ft, *Shevock* 57231; North Russian Creek along county road 1C01, 2 mi above North Fork Salmon River Bridge, 16 Aug 2020, 3035 ft, *Shevock* 57295; county road 1C01 at Mill Creek, 5 mi W of Etna, 27 Aug 2020, 3950 ft, *Shevock* 57311; forest road 40N38 just above junction with road 40N61 at North Fork Salmon River, 4 Oct 2020, 2410 ft, *Shevock* 57595; Sugar Creek at Sugar Lake, 25 Jul 1980, 1500–1800 m, *Norris* 57307 (UC); trail Creek above forest road 39N06, 26 Oct 2020, 4850 ft, *Shevock* 57805; confluence of North Russian and South Russian Creeks, 25 Feb 2021, 2665 ft, *Shevock* 57990; **RW**: trail to Sugar Lake, Jun 2012, 4680 ft, *Shevock* 40378; South Russian Creek Trail at the switchbacks, 3 Oct 2020, 5570 ft, *Shevock* & *York* 57543; Sugar Creek about 0.5 mi above forest road 41N14, 28 Oct 2020, 48540 ft, *Shevock* 57873, 57877.

Straminergon stramineum (Dicks. ex Brid.) Hedenäs
This species is pale green or straw-colored and grows as loose tufts or scattered shoots in fens. The leaves are mostly oblong with a weak costa and the alar cells are abruptly inflated, forming a distinct group. Specimen cited. **RW**: fen at S end of Taylor Lake, 15 Oct 2020, 6400 ft, *Shevock* 57637.

Syntrichia norvegica F. Weber

Although widespread in subalpine and alpine areas in California, this species is surprisingly rare in the study area. *Syntrichia norvegica* often has a glaucous appearance. The completely reddish awns and large laminal leaf cells are important diagnostic traits.

Specimens cited. **RW**: W of Sugar Lake, 6 Oct 2012, 1860 m, *Kellman & Shevock* 6947 (CAS); Eaton Lake Trail near ridge, 17 Oct 2020, 6425 ft, *Shevock* 57771.

Syntrichia princeps (DeNot.) Mitt.

This is a common species primarily on boulders with needle litter in coniferous forests. Most plants, especially while hydrated, have a bluish-green cast with the basal portions of the shoots with a rust-orange hue.

Specimens cited. **LS**: county road 1C02 at Jackson Creek, 23 Apr 1984, 1500 m, *Norris* 70520 (UC); forest road 39N48 at switchbacks above Carter Meadows Summit, 15 Aug 2020, 6400 ft, *Shevock* 57287; South Russian Creek Trail about 1 mi from the trailhead, 30 Aug 2020, 4690 ft, *Shevock & Magnaghi* 57427; Meeks Meadow Creek above Meeks Meadow Lake, 16 Oct 2020, 6225 ft, *Shevock* 57716; forest highway 39, 0.6 mi above junction with county road 1C02, 27 Oct 2020, 4130 ft, *Shevock* 57864; county road 1C01, 4.7 mi W of Etna Summit paralleling North Fork Russian Creek near confluence with Taylor Creek, 2 Dec 2020, 3490 ft, *Shevock* 57934; **RW**: trail to Sugar Lake, 20 Jun 2012, 5800 ft, *Shevock* 40382; trail below junction of Big Duck Lake and Little Duck Lake, 3 Jul 2020, 5800 ft, *Shevock & Magnaghi* 56975; Paynes Lake Trail about 0.5 mi below junction with the Pacific Crest Trail, 14 Aug 2020, 6000 ft, *Shevock* 57245; trail between Taylor Lake and Hogan Lake, 28 Aug 2020, 6000 ft, *Shevock & Magnaghi* 57352; South Russian Creek Trail at the wilderness boundary, 3 Oct 2020, 5195 ft, *Shevock & York* 57514.

Syntrichia ruralis (Hedw.) F. Weber & D. Mohr

Well developed plants of this *Syntrichia* Brid., species have strongly squarrose-recurved leaves when moist and smaller laminal cells than *Syntrichia norvegica*. It is uncommon in the study area.

Specimens cited: **RW**: head of Sugar Lake, 18 Aug 1973, 5900 ft, *McGrew* 0018 (UC); outlet stream of Taylor Lake, 1 Aug 2020, 6400 ft, *Brooks & Shevock* 4081 (CAS).

Syntrichia sp. 1.

This is a relatively widespread species in California within coniferous forests that remains without a published name. A diagnostic feature is the wide costa at the leaf base.

Specimens cited. **LS**: Pacific Crest Trail about 3 mi S of Enta Summit above Smith Lake, 8 Jul 2003, 2200 m, *Norris & Hillyard* 105773, 105777 (UC); forest road 40N83 just below Bingham Lake Trailhead and slopes well above Jackson Lake, 30 Jun 2020, 6680 ft, *Shevock* 57122; forest road 40N54 at Russian Creek, 27 Aug 2020, 2580 ft, *Shevock* 57349; Trail Creek between crossing of forest road 39N06 and county road 1C02, 26 Oct 2020, 4850 ft, *Shevock* 57817; **RW**: Pacific Crest Trail S of junction to Statue Lake, 2 Oct 2020, 6950 ft, *Shevock & York* 57504.

Timmia austriaca Hedw.

This is a robust plant which usually grows in dense tufts in shade. The leaves are linear-lanceolate and have an orange-colored sheathing base, visible with a hand-lens. Sporophytes are rare.

Specimen cited. **LS**: Mill Creek off of county road 1C01, 5 mi SW of Etna, 15 Oct 2020, 3950 ft, *Shevock* 57631.

Timmiella anomala (Bruch & Schimp.) Limpr.

This moss grows in short tufts of unbranched stems and the leaves are incurved when dry. It has bistratose leaf lamina and shows two stereid bands in cross section. The habitat is bare soil or soil over rock mixed with other mosses.

Specimens cited. **LS**: county road 1C01, 3.2 mi W of Etna Summit just below Jumpoff Joe Curve, 2 Dec 2020, 4125 ft, *Shevock* 57911; **RW**: South Russian Creek Trail at the switchbacks, 3 Oct 2020, 5570 ft, *Shevock & York* 57544.

Tortula hoppeana (Schultz) Ochyra

[*Tortula euryphylla*; *Desmatodon latifolius* in McGrew 1974]

This subalpine to alpine moss is most often found growing in dense tufts in shaded rock crevices. The leaf cells are strongly papillose and the costa ends in a mucro or short awn. Sporophytes are frequent.

Specimens cited. **RW**: Big Duck Lake, 13 Oct 1972, 6600 ft, *Norris* 23356 (UC); Russian Lake, 9 Sep 1973, 7000 ft, *McGrew* 0395, 0398 (UC); rocky slopes above S end of Taylor Lake, 15 Oct 2020, 6650 ft, *Shevock* 57643, 57644.

Tortula subulata Hedw.

This is the type species of the genus *Tortula* Hedw. It forms short tufts and usually has sporophytes. The oblong leaves have a border of elongate cells, a shortly excurrent nerve and the very long capsules are slightly curved. It prefers exposed soil in forest openings and is frequently encountered on road banks.

Specimens cited. **LS**: Duck Lake Trail near forest road 41N14, 11 Jun 1972, 5500 ft, *Norris* 22808 (UC); forest road 41N14, 2.4 mi from junction with county road 1C02 and S of Sugar Creek Trailhead, 28 Oct 2020, 4960 ft, *Shevock* 57894a; North Fork Salmon River paralleling county road 1C01, 1.8 mi W of Idlewild Campground, 25 Feb 2021, 2480 ft, *Shevock* 58006.

Trachybryum megaptilum (Sull.) W.B.Schof.

This is a large, showy yellow-green species commonly found on leaf litter with part of the stems buried in the duff. The tips of dried branches curl like a young fern frond. Sporophytes are infrequently encountered. Some bryologists place this species within *Homalothecium*, but we prefer to recognize it as a monospecific genus. In the project area, it is encountered at lower elevations below a prolonged snowpack in mixed conifer forests with a hardwood component. Two other large moss species, *Hylocomiadelphus triquetrus* and *Kindbergia oregana* can be associated with *Trachybryum*.

Specimens cited. **LS**: county road 1C02 at Shadow Creek, 13 Jun 2020, 2870 ft, *Shevock* 56792; forest road 40N54 at Russian Creek, 2 Aug 2020, 2580 ft, *Shevock* 57189; Paynes Lake Trail, 14 Aug 2020, 4800 ft, *Shevock* 57269; forest road 40N38 near junction with 40N61, S side North Fork Salmon River, 4 Oct 2020, 2410 ft, *Shevock* 57594; Russian Creek below forest road 40N54 near confluence with the North Fork Salmon River, 16 Oct 2020, 2580 ft, *Shevock* 57663; forest road 39N20, 1 mi above junction with county road 1C02, 27 Oct 2020, 3330 ft, *Shevock* 57840.; county road 1C01, 4.7 mi W of Etna Summit paralleling North Fork Russian Creek, 2 Dec 2020, 3490 ft, *Shevock* 57915; forest road 40N54, 1 mi from junction with county road 1C01, 25 Mar 2021, 2990 ft, *Shevock* 58157.

Tripterocladium leucocladulum (Müll.Hal.) A.Jaeger
In Norris and Shevock (2004a), this species was known from California from a single collection obtained in 1938 along the West Fork Beaver Creek, Siskiyou County. It remains rare in the state because only a couple of collections have been discovered during the intervening years. The Salmon Mountains population is the southernmost documented for this taxon. Plants are known to occur on both hardwood trunks and boulders in filtered light in riparian areas. The Russian Creek population is the first in California observed with sporophytes.

Specimens cited. **LS**: Along North Russian Creek off of county road 1C01, 2 mi from North Fork Salmon River Bridge, 16 Aug 2020, 3035 ft, *Shevock* 57297; Russian Creek near the confluence with the North Fork Salmon River below forest road 40N54, 16 Oct 2020, 2580 ft, *Shevock* 57668.

Trochophyllohypnum circinale (Hook.) Jan Kučera & Ignatov

[*Hypnum circinale*]

This species forms thin, pale green mats on conifer bark (especially *Abies concolor* and *Pseudotsuga menziesii*) in mid-elevation forests. Known historically as a member of the genus *Hypnum*, a recent phylogenetic study (Kučera et al. 2019), clearly demonstrated the polyphyletic nature of this large genus. *Hypnum circinale* Hook., was elevated as a monospecific genus and transferred from the Hypnaceae to the Pylaisiadelphaceae.

Specimens cited. **LS**: South Russian Creek Trail about 1 mi from trailhead, 30 Aug 2020, 4690 ft, *Shevock & Magnaghi* 57418; Trail Creek above crossing of forest road 39N06, 26 Oct 2020, 4850 ft, *Shevock* 57801; **RW**: trail between Taylor Lake and Hogan Lake, 28 Aug 2020, 6030 ft, *Shevock & Magnaghi* 57360; South Russian Creek Trail at the switchbacks, 3 Oct 2020, 5570 ft, *Shevock & York* 57540.

Weissia controversa Hedw.

This widespread moss is infrequently encountered in the study area. It grows in loose to dense tufts on soil and the leaf margins are strongly incurved. Capsules are ovoid to ellipsoid with peristome varying from rudimentary to well-developed.

Specimens cited. **LS**: county road 1C01 at junction with forest road 40N61 above the North Fork Salmon River, 25 Feb 2021, 2470 ft, *Shevock* 57976; county road 1C01, 1.5 mi W of North Fork Salmon River Bridge from Idlewild Campground, 25 Feb 2021, 2500 ft, *Shevock* 57995; **RW**: Paynes Lake, 2 Aug 1975, 6000 ft, *Norris & Smith* 46326, 46340 (UC); Sugar Lake Trail, 6 Oct 2012, *Kellman & Shevock* 6948 (CAS).

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APPENDIX 1

A SUBSET OF MCGREW AND NORRIS COLLECTIONS CITED IN MCGREW (1976) AND ANNOTATED AS DIFFERENT TAXA.

Group	Reported as	Annotated to
Liverworts	<i>Asterella tenella</i>	<i>Mannia gracilis</i> [Norris & McGrew 45610]
	<i>Diplophyllum gymnostomophilum</i>	<i>Diplophyllum obtusifolium</i> [Norris & McGrew 45613]
	<i>Plagiochila asplenioides</i>	<i>Plagiochila porelloides</i> [McGrew 0043, 0061, 0065, 0075]
	<i>Riccia californica</i>	<i>Riccia beyrichiana</i> [Norris & McGrew 45611]
Mosses	<i>Amblystegium juratzkanum</i>	<i>Amblystegium serpens</i> [Norris 45621]
	<i>Arctoa fulvella</i>	<i>Kiaeria starkei</i> [McGrew 0378]
	<i>Brachythecium albicans</i>	<i>Brachythecium erythrorrhizon</i> [McGrew 0057]
	<i>Brachytheccium erythrorrhizon</i>	<i>Brachythecium albicans</i> [McGrew 0059]
	<i>Brachythecium holzingeri</i>	<i>Eurhynchiastrum pulchellum</i> [Norris & McGrew 45632]
	<i>Bryum alpinum</i>	<i>Gemmabryum caespiticism</i> [McGrew 0246]
		<i>Pohlia bolanderi</i> [McGrew 0652]
		<i>Pohlia drummondii</i> [McGrew 0203, 0204]
		<i>Pohlia nutans</i> [McGrew 0650]
	<i>Bryum caespiticism</i>	<i>Pohlia bolanderi</i> [McGrew 0250, 0408, 0633, 0669]
		<i>Pohlia camptotrachela</i> [McGrew 0370]
		<i>Pohlia cruda</i> [McGrew 0356, 0621]
		<i>Pohlia drummondii</i> [McGrew 0085]
		<i>Pohlia nutans</i> [McGrew 0002, 0004, 0069, 0208, 0222, 0527, 0559]
		<i>Ptychostomum</i> sp. (sterile) [Norris & McGrew 45628]
		<i>Ptychostomum</i> sp. (sterile) [Norris & McGrew 45654]
		<i>Pohlia nutans</i> [McGrew 0654]
	<i>Bryum capillare</i>	<i>Imbribryum torenii</i> [Norris & McGrew 45593]
	<i>Bryum creberrimum</i>	<i>Bryum calobryoides</i> [McGrew 0629]
	<i>Bryum pallens</i>	<i>Hymenoloma crispulum</i> [McGrew 0072, 0076, 0080, 0358]
	<i>Bryum tortifolium</i>	<i>Scleropodium obtusifolium</i> [McGrew 0212]
	<i>Dicranoweisia crispula contermina</i>	<i>Grimmia brevirostris</i> [Norris & McGrew 45589, 45607]
	<i>Eurhynchium riparioides</i>	<i>Grimmia hamulosa</i> [Norris & McGrew 45609]
	<i>Grimmia incurva</i>	<i>Grimmia alpestris</i> [McGrew 0130; Norris & McGrew 45635]
	<i>Grimmia tenerrima</i>	<i>Kiaeria starkei</i> [McGrew 0624, 0626, 0631, 0660]
	<i>Kiaeria falcata</i>	<i>Pohlia camptotrachela</i> [McGrew 0468]
	<i>Leptobryum pyriforme</i>	<i>Pohlia cruda</i> [McGrew 0195]
		<i>Sanionia uncinata</i> [McGrew 0338]
	<i>Leptodictyum riparium</i>	<i>Pohlia bolanderi</i> (seriata form) [McGrew 0382]
	<i>Mielichhoferia mielichhoferi</i>	<i>Lewinskya arida</i> [McGrew 0109, 0369]
	<i>Orthotrichum speciosum</i>	<i>Philonotis pumila</i> [McGrew 0369]
	<i>Philonotis capillaris</i>	<i>Pohlia cruda</i> [McGrew 0159]
	<i>Sphagnum subsecundum</i>	<i>Sphagnum miyabeanaum</i> [McGrew 0304, 0459, 0470, 0597, 0598]
	<i>Stokesiella oregana</i>	<i>Kindbergia praelonga</i> [McGrew 0039, 0100, 0161, 0162, 0178]

A FLORA OF THE MOSSES OF THE CASCADE-SISKIYOU NATIONAL MONUMENT IN OREGON AND CALIFORNIA

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ABSTRACT

The moss flora of the Cascade-Siskiyou National Monument, located on the border of southwest Oregon and northwest California, comprises 201 moss species and one variety within 89 genera and 37 families. The majority of the Cascade-Siskiyou National Monument is in Oregon and it comprises less than 0.2 percent of the state; however, roughly 38 percent of moss species known to Oregon were found. Forty species recorded during work for this manuscript are rare or under-collected in Oregon and six are newly reported to the state. Species reported new to Oregon include *Grimmia attenuata* (Müll.Hal. & Kindb.) Kindb., *Meesia longiseta* Hedw., *Physcomitrella readeri* (Müll.Hal.) I.G.Stone & G.A.M.Scott, *Pseudocalliergon angustifolium* Hedenäs, *Schistidium splendens* T.T.McIntosh, H.H.Blom, D.R.Toren & Shevock, and *Weissia ligulifolia* (E.B.Bartram) Grout.

Key Words: bryoflora, bryogeography, bryophyte inventory, California Floristic Province, Cascade-Siskiyou National Monument, moss flora, mosses, southern Oregon.

The Cascade-Siskiyou National Monument (CSNM; the Monument) is located primarily in southwest Oregon with a small portion crossing into California east of Interstate 5 (I-5) (Fig. 1). The Monument was designated on June 9th, 2000 by President Bill Clinton under the Antiquities Act of 1906 and subsequently expanded in 2017 by President Barack Obama. Situated near the small city of Ashland, Oregon, the CSNM is designated as a preserve to harbor biodiversity and is named for its locality at the crossroads of the ancient Siskiyou Mountains and the relatively young Cascade Range. The Monument is currently 114,000 acres (46,134 hectares) with an elevational range that covers just over 4100 feet (ft) (1250 meters [m]). The lowest elevation is approximately 2400 ft (732 m) near Gaerky Creek just above the city of Ashland and the highest elevation is 6542 ft (1194 m) at the summit of Surveyor Mountain on the far eastern edge. Other prominent mountain peaks include Pilot Rock (5771 ft [1759 m]), Grizzly Peak (5922 ft [1805 m]), Chinquapin Mountain (6079 ft [1852 m]), Soda Mountain (6093 ft [1857 m]), and Old Baldy (6339 ft [1932 m]).

HYDROLOGY

Hydrology in the Monument is complex and consists of many creeks and streams that drain into the Rogue and Klamath River basins. In the southern portion of the CSNM, the Klamath Basin receives input from Jenny Creek, Camp Creek, and Scotch Creek. These creeks flow into the Klamath River at Iron Gate Reservoir, which lies just outside of the Monument boundary in California. In the northern part of the CSNM, creeks flow into the Rogue River Basin. The main river systems that carry water to the Rogue River are Bear Creek and Little Butte Creek, both of which are not in the

Monument. Tributaries to Bear Creek within the Monument include Hill Creek, Carter Creek, Emigrant Creek, and Sampson Creek, which all feed into Emigrant Lake, a reservoir just east of the city of Ashland. In the northwest, tributaries such as Antelope Creek and Lost Creek flow into Little Butte Creek. The confluences of both Bear Creek and Little Butte Creek with the Rogue River are near the town of White City, Oregon, roughly 20 miles west of the Monument.

LAND OWNERSHIP

The Monument is located within the traditional territories of the Shasta, Takelma, and Klamath people. Today, the Monument is a patchwork of both federal and state lands and within its boundaries includes many private inholdings. Administration of the Monument is primarily carried out by the Medford Bureau of Land Management (BLM) Ashland Resource Area; the BLM and California Department of Fish and Wildlife co-administer the Horseshoe Ranch Wildlife Area in California. In addition, the Fremont-Winema National Forest manages a small parcel at the eastern edge on Surveyor Mountain (C. Schelz, Medford BLM, personal communication). Access to the CSNM is excellent due to the patchwork of ownership and the main highways passing through or adjacent to it; these include Green Springs Highway (Highway 66), which passes through the center of the Monument from east to west, and Dead Indian Memorial Rd, which passes through the western side and runs generally northeast through the northern part of the Monument. In addition, the Monument's southern border can be reached from California from Iron Gate Lake Rd, which runs along the west side of Iron Gate Lake. From these main arteries, many addi-

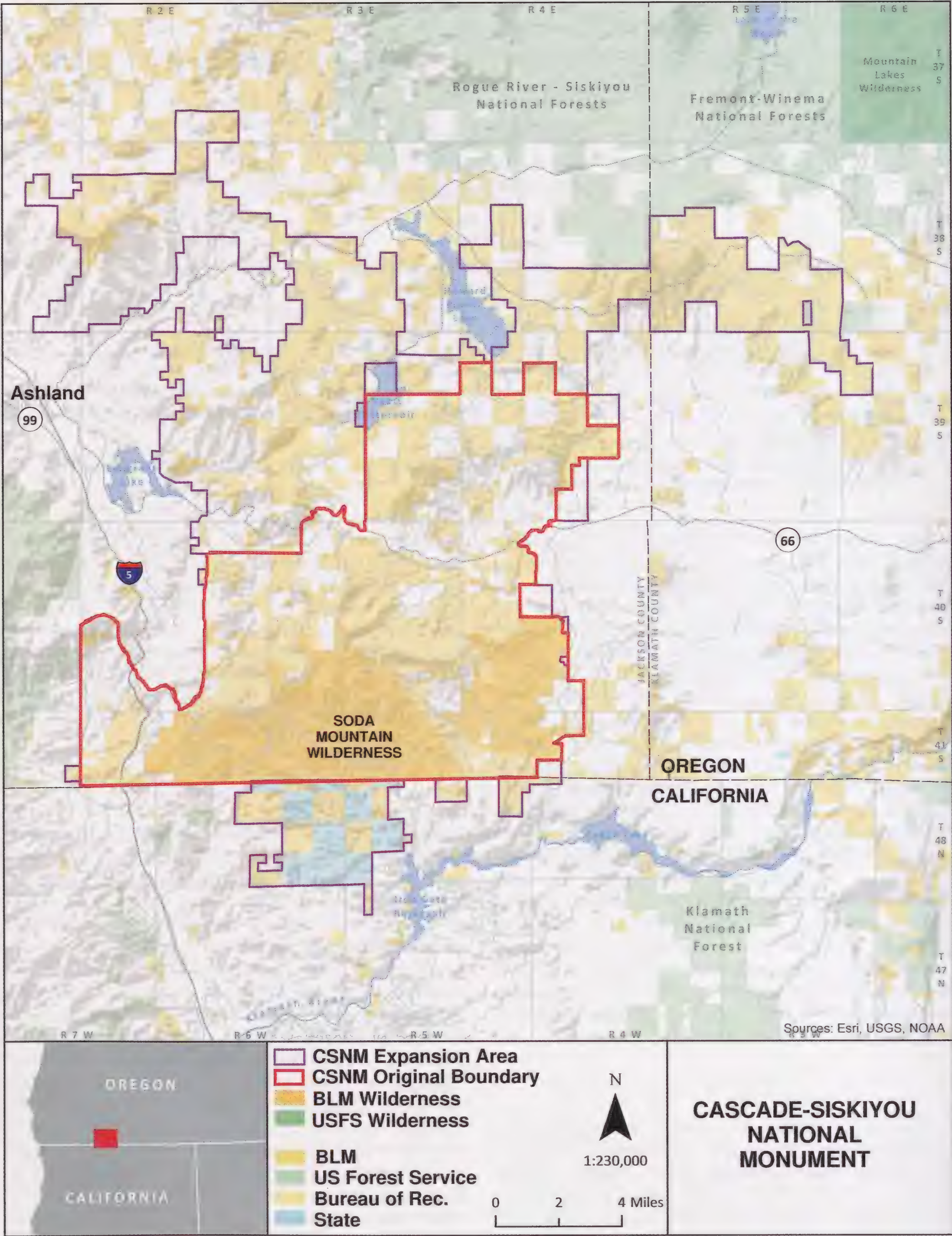


FIG. 1. Map of the Cascade-Siskiyou National Monument (courtesy of the Bureau of Land Management).

tional BLM, Forest Service, and county roads provide access to different portions of this vast area. Within the Monument are a multitude of lands that maintain their own special federal designations.

The largest of these is the 24,700-acre Soda Mountain Wilderness, designated in 2009. Another smaller preserve located in the extreme south and a recent addition to the Monument is the 222 acre

Mariposa Lily Botanical Area. In addition, two Wild and Scenic River designations occur, Jenny Creek and Spring Creek, as well as many Areas of Critical Environmental Concern, Research Natural Areas, and 30 miles of the Pacific Crest Trail. Two large private preserves also exist within the Monument boundaries, the 4761-acre Sampson Creek Preserve administered by the Selberg Institute and the 1700-acre Sharon Fen Preserve administered by The Nature Conservancy.

CLIMATE

The climate of southern Oregon is Mediterranean with cool wet winters and warm dry summers. Though relatively close to the coast, the topography rarely allows marine fog to reach the area, resulting in low humidity in summer months. Valleys and foothills experience mild winters with hot summers, while higher elevations can experience severe winters with deep snowpack and much cooler summers. Ashland, Oregon, at an elevation of 1949 ft (594 m), receives an average of 20 inches (51 centimeters [cm]) of precipitation annually, while nearby Green Springs, Oregon, at 2440 ft (744 m), averages 23 inches (58 cm) per year, and Howard Prairie, to the east of Green Springs and at 4570 ft (1393 m), receives an average of 32 inches (81 cm) of precipitation per year (WRCC 2020).

GEOLOGY

The geology of the Monument is dominated by volcanism that occurred in two episodes. The first of which, called the Western Cascades, erupted during the Oligocene and Miocene epochs and the second, called the High Cascades, occurred in the Pliocene and Pleistocene. The Western Cascades range from 33 to 19 million years old (myo) and consist almost entirely of highly dissected basaltic andesite lava flows with occasional dacite, rhyolite, and diorite. Volcaniclastics that occur largely in the form of volcanic ash deposits have resulted in the clay soils that can be found among the Monument's extensive grassland communities. In addition, there are small areas of welded tuff, boulder debris flows, and volcanic sandstone; the most notable of these are in the Coletín Valley on the southwestern edge of the Monument. The second episode, the High Cascades, age from six to 0.33 myo and form the plateau region in the central and eastern areas of the CSNM; these areas consist of low-profile shield volcanoes dominated by dark lava flows. Most of these volcanoes have vanished from the landscape, however they are detectable by their resultant lava flows. An exception to the volcanic history of the Monument can be found in a small area northeast of Siskiyou Pass where granitic rocks of the older Mount Ashland Pluton (165 myo) are overlain by younger tilted green sandstone and shale of the Hornbrook Formation (95 myo). These are the oldest rocks in the

Monument and are a part of the Klamath Mountains (D'Allura, Southern Oregon University, personal communication).

There are many notable geologic features in this area, the most observable of which is the iconic volcanic plug of Pilot Rock, a striking feature just east of the I-5 at the California-Oregon border and a symbol of the Monument. Another easily visible shield volcano, and the dominant viewshed of the city of Ashland, is Grizzly Peak. This volcano is roughly 25 myo and has an ancient and extinct caldera on its north side. Another visible feature far to the east is Surveyor Mountain, a long flat-topped mountain that contains the highest elevations in the Monument. This mountain is an example of a young fault block mountain, such as those seen near Klamath Falls, Oregon.

PLANT COMMUNITIES

Plant communities within the Monument are diverse and occur as a mosaic with factors such as elevation, soil type, and aspect influencing community composition and location. The Monument is incredibly unique in that it incorporates vegetation types from the Cascade Range, Klamath Mountains, and the Great Basin. In general, the most common vegetation types are chaparral, oak woodland, and mixed conifer forest. Because the Monument lies within the larger California Floristic Province, plant community descriptions generally follow Sawyer et al. (2009) and include chaparral communities such as buck brush chaparral and 'rosaceous chaparral' (Frost 2017), Oregon white oak woodland, California black oak woodland, Ponderosa pine-incense cedar forest, Ponderosa pine-Douglas fir forest, Douglas fir forest, white fir-Douglas fir forest, red fir-white fir forest, and red fir forest.

Chaparral communities in the Monument generally occur at low to mid elevations in hotter, drier zones and are often associated with other vegetation types, occupying rocky areas in grasslands or gaps in woodlands or evergreen forests. Buckbrush chaparral occurs mostly in the south on well-drained rocky soils and is dominated by *Ceanothus cuneatus* (Hook.) Nutt., with associated species such as *Garrya fremontii* (Torr.), *Arbutus menziesii* Pursh, and *Arctostaphylos viscida* Parry. Rosaceous chaparral, so named because all its members are in the rose family, occurs on well-drained soils at mid elevations on the west side of the Monument within oak woodlands or gaps in evergreen forest types (Frost 2017); dominant species include *Prunus subcordata* Benth., *Prunus emarginata* (Douglas) Eaton, *Ame-lanchier alnifolia* (Nutt.) Nutt. ex M.Roem., and *Cercocarpus betuloides* Nutt. Bryophytes in these areas are common and highly visible with the most discernable species at a glance belonging to groups on dry rock such as *Grimmia* Hedw., *Syntrichia* Brid., and *Didymodon* Hedw.

Oak woodlands occur at low to mid elevations on flats and foothills, mostly on southern aspects. Oak woodlands occur on a range of soil types and dominate large parts of the southern portion of the Monument. Oregon white oak woodland, Brewer's oak woodland, and California black oak woodland often occur together at mid elevations; however, Oregon white oak is dominant at lower elevations. Species occurring in these habitats include *Quercus garryana* Douglas ex Hook. var. *garryana*, *Quercus garryana* var. *breweri* (Engelm.) Jeps., and *Quercus kelloggii* Newb.; in areas with Great Basin influence, *Juniperus occidentalis* Hook., is also common. The dominant understory species are *Toxicodendron diversilobum* (Torr. & A.Gray) E.Greene, *Ceanothus integerrimus* Hook. & Arn., *Ceanothus cuneatus* (Hook.) Nutt., and *Ericameria nauseosa* (Pall. ex Pursh) G.L.Nesom & G.I.Baird, as well as members of the rosaceous chaparral community. The most prevalent mosses here grow on bark and soil and include groups such as *Pulviger* Plásek, Sawicki & Ochyra, *Antitrichia* Brid., *Homalothecium* Schimp., and *Syntrichia*.

Ponderosa pine and incense cedar forest dominated by *Pinus ponderosa* P.Lawson & C.Lawson and *Calocedrus decurrens* (Torr.) Florin occur throughout the Monument at low to mid elevations from drainages to lower elevation plateaus. Soils tend to be volcanic and rocky with small outcrops and occasional exposed bedrock. This community is often ecotonal either bordering white oak woodland or higher elevation mixed conifer forest and species associated with these communities are also present. On lower elevation sites in the southwest, associates include *Arbutus menziesii*, *Toxicodendron diversilobum*, and *Ceanothus integerrimus*.

Mixed conifer forest is also widely distributed throughout the Monument and corresponds to three main communities: Ponderosa pine-Douglas fir, Douglas fir, and white fir-Douglas fir forests. These stands are primarily dominated by *Pinus ponderosa*, *Pseudotsuga menziesii* (Mirbel) Franco, *Calocedrus decurrens*, and *Abies concolor* (Gordon & Glend.) Lindl. ex Hildebr. Within the Monument, these communities occur on volcanic soils at mid to high elevations from drainages and flats to small peaks and plateaus. These forest types have an open understory often comprised of *Corylus cornuta* Marsh. subsp. *californica* (A. DC.) E.Murray, *Mahonia aquifolium* (Pursh) Nutt., *Holodiscus discolor* (Pursh) Maxim., *Amelanchier alnifolia* (Nutt.) Nutt. ex M.Roem., and *Rosa gymnocarpa* Nutt. Common mosses here grow on wood, litter, and rock and include *Isothecium cristatum* (Hampe) H.Rob., *Aulacomnium androgynum* (Hedw.) Schwägr., *Orthodicranum tauricum* (Sapjegin) Smirnova, *Brachythecium albicans* (Hedw.) Schimp., and *Bucklandiella heterosticha* (Hedw.) Bedn.-Ochyra & Ochyra.

The highest elevation sites in the Monument are occupied by true firs such as *Abies concolor* and *Abies*

magnifica A.Murray var. *shastensis* Lemmon. These communities occur on volcanic soils on plateaus and high peaks. Examples include the highest peak in the Monument, Surveyor Mountain at 6542 ft (1994 m), and areas around Soda Mountain and Old Baldy Mountain as well. Much of this forest type within the Monument is late successional with large well-spaced trees and an extremely open and depauperate understory. Common associates here include *Chrysopsis chrysophylla* (Hook) Hjelmq., *Prunus emarginata*, *Paxistima myrsinites* (Pursh) Raf., *Arctostaphylos nevadensis* A.Gray, *Arctostaphylos patula* Greene, and *Ceanothus velutinus* Douglas. This community shares typical moss genera with lower elevation forest communities; however, many species change as elevation increases. One notable difference is the increased presence of *Pseudoleskea* Schimp., species among this community as elevation increases. At moderate elevations, this genus is restricted to shadier, cooler sites and vegetation types, however this genus becomes quite common on boulders in the fir zone where four *Pseudoleskea* species are encountered.

COLLECTION HISTORY

The collection history of the Monument suggests that collection in the past has been spotty, with very few vouchered collections in regional and national herbaria. The earliest collection record for the Monument is a single collection by W.B. Schofield in 1964 of *Coscinodon calyptratus* (Drumm.) C.E.O.Jensen with the location given as "near Siskiyou Pass, state boundary." The next set of collections are by David Wagner obtained from just east of Pilot Rock in the 1980s. Wagner also collected the northern part of the Monument in the late 1990s, collecting many vouchered specimens west of Howard Prairie Lake. In addition, Steve Jessup and Scot Loring have collected throughout the Monument for the past three decades, however their collections were not available for study during this project.

METHODS

Moss collections were carried out by the author at various times between 2018 and 2021. During collection, all relevant field data were written on collection packets with herbarium labels created in the lab. Collection sites were generally chosen in richer habitats in an attempt to capture as much diversity as possible, though exceptions do occur. Collecting began in and around the Colestin Valley in California in 2018 and generally moved north after that. Jim Shevock accompanied the author on a collecting foray in June 2020 and contributed many collections to this work.

The purpose of these collections was to further understand the distribution of mosses in this remote and under-collected area and these collections are the

TABLE 1. Rare or previously overlooked species in the Cascade-Siskiyou National Monument (CSNM; Monument). Bold = species that are reported as new to the state of Oregon.

Species name	Location in the CSNM
<i>Andreaea heinemannii</i>	Vicinity of Jenny Creek south of Pinehurst Inn
<i>Bryum calobryoides</i>	Vicinity of Pilot Rock and Hyatt Lake
<i>Bryum lanatum</i>	Vicinity of Pilot Rock
<i>Bucklandiella lawtoniae</i>	Lost Creek Falls
<i>Codriophorus depressus</i>	Hyatt Lake vicinity and Buck Lake vicinity
<i>Didymodon eckeliae</i>	Many locations throughout the Monument
<i>Didymodon insulanus</i>	Many locations throughout the Monument
<i>Didymodon nicholsonii</i>	Many locations throughout the Monument
<i>Didymodon norrisii</i>	Many locations throughout the Monument
<i>Drepanocladus longifolius</i>	Big Lake Fen (Sharon Fen Preserve)
<i>Fontinalis hypnoides</i>	Parsnip Lakes, Lost Lake
<i>Gemmabyum dichotomum</i>	Conde Creek Road, Dead Indian Creek
<i>Grimmia attenuata</i>	Soda Creek
<i>Grimmia lisae</i>	Round Mountain
<i>Imbribryum alpinum</i>	Vicinity of Soda Mountain
<i>Imbribryum torenii</i>	Many locations throughout the Monument
<i>Lewinskya holzingeri</i> [= <i>Orthotrichum holzingeri</i>]	Primarily southern portions of the Monument
<i>Lewinskya pylaisii</i>	Surveyor Mountain
<i>Meesia longiseta</i>	Big Lake, Sharon Fen Preserve
<i>Meesia uliginosa</i>	Tunnel Creek Wetlands
<i>Orthotrichum euryphyllum</i>	Primarily southern portions of the Monument
<i>Physcomitrella readeri</i>	Emigrant Lake
<i>Pohlia bolanderi</i>	Surveyor Mountain, Vicinity of Old Baldy Peak
<i>Pseudocalliergon angustifolium</i>	Big Lake Fen (Sharon Fen Preserve)
<i>Pseudocrossidium hornschuchianum</i>	Vicinity of Gaerky Creek near Ashland
<i>Pseudoleskea saviana</i>	Howard Prairie Lake, Sharon Fen Preserve
<i>Rectithecium piliferum</i> [= <i>Plagiothecium piliferum</i>]	Lost Creek
<i>Rosulabryum elegans</i>	Vicinity of Skookum Creek and vicinity of Joes Rock
<i>Rosulabryum flaccidum</i>	Vicinity of Green Springs Mountain and vicinity of Shale City Road
<i>Rosulabryum gemmascens</i>	Many locations throughout the Monument
<i>Rosulabryum torquescens</i>	Pilot Rock Trail
<i>Schistidium cinclidodonteum</i>	Primarily southern portions of the Monument
<i>Schistidium confertum</i>	Many locations throughout the Monument
<i>Schistidium flaccidum</i>	Vicinity of Little Pilot Rock
<i>Schistidium heterophyllum</i>	Vicinity of Joes Rock
<i>Schistidium splendens</i>	Many locations throughout the Monument
<i>Scleropodium occidentale</i>	Many locations throughout the Monument
<i>Syntrichia laevipila</i>	Southwest areas of the Monument
<i>Tomentypnum nitens</i>	Tunnel Creek Wetlands
<i>Weissia ligulifolia</i>	Lost Creek Canyon

basis of this flora. The main references for the identification of mosses are volumes 27 and 28 of *Flora of North America North of Mexico* (Flora North America Editorial Committee 2007, 2014) though many additional publications were also used. For *Orthotrichum*, this flora follows Lara et al. (2020), Vigalondo et al. (2020), and Medina et al. (2012); *Plagiothecium* follows Wynns et al. (2018); *Hypnum* follows Kučera et al. (2019); *Rhytidiadelphus* follows Ignatov et. al. (2019); and *Dicranoweisia crispula* follows Ochyra et al. (2003). All specimens cited here were sent to Jim Shevock and David Toren at the California Academy of Sciences (CAS) for confirmation or determination and were deposited in that herbarium. Additional specimens for this manuscript were located using the online resources Consortium of North American Bryophyte Herbaria (2020) and Consortium of Pacific Northwest Her-

baria (2020) websites and several of these collections are included within this catalogue. Except for collections made by Jim Shevock and Rick Dewey, all specimens cited here by additional collectors were not sent to CAS and are housed at different herbaria. These herbaria are noted in parentheses by herbarium abbreviation in the species accounts after the specimen number in the Catalogue.

Many collections made during work for this manuscript are considered ‘rare’ in Oregon and a list of these can be found in Table 1, as well as a discussion of many of them in the results section below. Determination of rarity was made in some cases by using the list of rare species for Oregon produced by the Oregon Biodiversity Information Center (Christy and Wagner, 2019) and in other cases was defined by the author as species that have five or fewer known records within the state.

RESULTS AND DISCUSSION

For this study, 1024 specimens were collected and examined; of these, approximately 97 percent were collected by the author. The majority of specimens collected for this project are cited in the catalogue of this manuscript; however, in areas where many collections of the same taxa were collected at the same location, only one of these collections is cited. Currently, the Monument is estimated to contain 201 moss species and one variety within 89 genera and 37 families. The number of species listed here is assumed incomplete as some species that would have been expected were not detected. Most likely this is because they occur in small quantities, were overlooked due to extremely small size, or they are ephemeral. According to Christy and Wagner (2019), 520 moss species are known from the state of Oregon. The 201 moss species identified during this study indicate that the Monument contains roughly 38 percent of the moss species known from the state of Oregon (as of 2019), which is remarkable because it accounts for less than 0.2 percent of the state. Within the muchsmaller portion of the Monument located in California, 57 species were found, three of which, *Conardia compacta* (Müll.Hal.) H.Rob., *Orthotrichum alpestre* Hornsch. ex Bruch & Schimp., and *Orthotrichum cupulatum* Hoffm. ex Brid., are unique to the California portion of the study area.

The Monument has a great diversity of mosses and many maintain some level of federal or state conservation status, though some rare species still lack formal designation. For this manuscript, species considered rare are those with either a federal or state designation or those with five or fewer vouchered state records; a list of these species is given in Table 1. During work for this manuscript, it was discovered that some species considered rare are quite common within the Monument, while others are extremely rare.

In total, 40 rare or under collected species were found in the Monument (Table 1); the six species previously unreported in the state are described below. New to Oregon is a population of *Pseudocalliergon angustifolium* Hedenäs that was found at Big Lake within the Sharon Fen Preserve. This species, a member of the Amblystegiaceae, is a small fen-dwelling species that has its major distribution in the boreal region of the world, however, it has been found many times in California. Also found at Sharon Fen Preserve was a small population of *Meesia longiseta* Hedw.; on the west coast, this species is only known from two populations in California and two populations from northern Washington, along with many populations in British Columbia. Another species reported here as new to Oregon is *Grimmia attenuata* Müll.Hal. & Kindb., the first population in Oregon was found by the author in Douglas County near Camas Valley and was subsequently found one month later within the Monument; this species prefers similar habitats to

that of *Grimmia trichophylla* Grev., *G. lisae* DeNot., and *G. leibergii* Paris, *Schistidium splendens* T.T.McIntosh, H.H.Blom, D.R.Toren & Shevock was also found within the Monument in many locations and is likely the most common member of this genus located here; however, because this species was not described until 2015, it has most likely been misidentified or simply overlooked in the past. *Weissia ligulifolia* (E.B.Bartram) Grout was found in Lost Creek Canyon on a south-facing grassy slope deep in the recess of a small boulder. This population is the most interesting discovery of this work because this species is primarily found in much drier climates in the southwestern United States east of the Cascade and Sierra Nevada divide. Though populations of this species have been found in coastal California, once near San Luis Obispo and also from the Channel Islands, the majority of known populations of this species are in southern Nevada, southern Arizona, southern New Mexico, southwest Texas, and Colorado. Just a few hundred feet outside Monument boundaries within the bed of Emigrant Lake near Ashland, a population of the extremely rare *Physcomitrella readeri* (Müll.Hal.) I.G.Stone & G.A.M.Scott was found. This species prefers mud-flats of lake banks or reservoirs and can typically be found during low water events from late summer through winter months. This location represents only the third population reported in North America.

An interesting addition to the flora was the discovery of a population of *Bucklandiella lawtoniae* (Ireland) Bedn.-Ochyra & Ochyra which has only twice before been reported from Oregon and once from California. This species is associated with wet areas and waterfalls and was found within its typical habitat near Lost Creek Falls. Another interesting find and the second record for the state of Oregon is the extremely rare *Pseudocrossidium hornschurchianum* (Schultz) R.H.Zander. This species has extremely disjunct populations in North America with a handful of locations reported for California, many in British Columbia, and at least one record from Massachusetts. *Schistidium flaccidum* (DeNot.) Ochyra was another species of note found during the work for this manuscript. This species has a very spotty record in the Pacific Northwest with very few records occurring, two of which are from Oregon in Marion and Harney counties. This species seems to prefer basaltic outcrops in drier situations with most locations occurring east of the Cascades and Sierra Nevada.

Two undescribed species were found within the Monument and both were encountered many times during work for this study. The first, a species of *Syntrichia*, is widely reported in California and Oregon with the author finding this species throughout the Monument and as far north in Oregon as Opal Lake in the Willamette National Forest. It has much the same habit as other large *Syntrichia* from the region and like these can be found from low to high elevations occurring in a variety of habitats and

differing substrates. This species belongs to the 'waisted' group within the genus meaning that there is a constriction at the middle of the leaf and the costa is wide at the leaf base. The second species likely represents a member of the genus *Plagiobryoides* and is given in the Catalogue as such. This plant was encountered three times in the southern part of the Monument on dry rock in areas with at least some Great Basin influence and is widespread in California, especially in ephemeral stream channels. The plant appears to be related to *P. renauldii* more frequently encountered in Arizona and New Mexico. This species is currently part of a phylogenetic study to ascertain its placement and a name to apply to these collections (J. Shevock, CAS, personal communication).

CONSERVATION IMPLICATIONS

The Monument has a wonderful diversity of mosses and within its boundaries contains many species of conservation concern. A few of these species that are rare either statewide or globally can be found commonly within the Monument, however others are quite rare and cannot be found without specific searching.

Because the Monument is under federal protection, the primary threat to rare species found here is climate change, and more specifically, an increase in the number and severity of fires. In 2018, the Klamathon Fire burned north from the city of Hornbrook, California into the southern part of the Monument in the Horseshoe Ranch Wildlife Area and the Soda Mountain Wilderness. Fortunately, a shift in wind direction kept the fire from continuing north and destroying a larger portion of the Monument. As warming increases and forested areas become increasingly imperiled, it is imperative that refugia for species, such as the CSNM, exist. Like the Monument, these refugia should contain as much elevational and topographic diversity as possible so that microhabitats and microclimates are maximized.

THE CATALOGUE

Taxa are listed alphabetically with family name given in parentheses followed by a brief habitat description that occasionally includes further taxonomic, bryogeographical, or ecological information. Next are examples of specimens found with their corresponding site numbers and collector(s). It should be noted that the number of specimens listed after each species varies widely and the number of specimens listed does not necessarily correspond to commonness, but rather, some groups were favored during collection to detect cryptic or rare species within those groups. All specimens collected by the author are housed at CAS. Those from other herbaria are cited with their respective collection numbers in the text. Species found just outside the boundary, but with no collections within the

Monument, are marked by an asterisk (*) and are included here when suitable habitat also occurs within the Monument.

Amblystegium serpens (Hedw.) Schimp. (Amblystegiaceae). Tree trunks, rotten wood, rock, soil from wet to dry habitats from low to high elevations.

Specimens cited: SW of Little Pilot Peak in small seasonal seep in mixed conifer forest on downed branch, *Brooks* 3655; Little Hyatt Lake, just below spillway in small cascading side channel on boulder, *Brooks* 4178; 300 ft E of small pond N of Big Lake on exposed root on soil and wood, *Brooks* 4311.

Amphidium mougeotii (Bruch & Schimp.) Schimp. (Orthotrichaceae). Seasonally wet crevices on cliffs at moderate elevations.

Specimen cited: 650 ft downstream of Lost Creek Falls on N-facing wall along creek, *Brooks* 4450b.

Anacolia baueri (Hampe) Paris (Bartramiaceae). On soil or rock, often associated with cliffs or large outcrops. This species can be distinguished from the similar *A. menziesii* by a capsule that is oblong to short cylindric vs ovoid to globose and a seta that is > 1 cm in length. When dry *A. baueri* has leaves on branch apices forming a tight cluster with subulae closely parallel versus a loose cluster with subulae slightly divergent (Norris and Shevock 2004).

Specimens cited: Just below E ridgeline above Jenny Creek on small boulder, *Brooks* 3297*; 2 mi NW of Agate Flat along Skookum Creek on dry rock, *Brooks* 3746; 0.8 mi SW of Old Baldy Mountain and just S of un-named peak at base of summit among large boulders, *Brooks* 4368; on rock slab directly next to Emigrant Creek Falls, *Brooks* 4672.

Anacolia menziesii (Turner) Paris (Bartramiaceae). On N-facing boulders and rock outcrops and cliffs.

Specimens cited: Boulder above Dutch Oven Creek, *Brooks* 2117; summit of Cathedral Cliffs on N-facing outcrop, *Brooks* 3163; 0.25 mi S of Pilot Rock near small peak on small outcrop, *Brooks* 3315; 2 mi NW of Agate Flat along Skookum Creek on branch of Oregon white oak, an unusual substrate, *Brooks* 3762; downstream of Lost Creek Falls on N side of creek on large rock wall, *Brooks* 4437.

Andreaea heinemannii Hampe & Müll.Hal. (Andreaeaceae). On boulders and outcrops from low to moderate elevations.

Specimen cited: On small W-facing talus slope within mixed conifer forest just E of Jenny Creek and 1 mi S of Pinehurst Inn, *Brooks* 4482.

Andreaea rupestris Hedw. (Andreaeaceae). On boulders and outcrops from mid to high elevations.

Specimens cited: 0.8 mi SW of Old Baldy Mountain and just S of un-named peak near summit on large rock wall, *Brooks* 4381; on rock pile in canopy gap overlooking Lost Creek Canyon, *Brooks* 4520.

Antitrichia californica Sull. ex Lesq. (Leucodontaceae). On rock and hardwood trees from shaded areas to full sun from low to moderate elevations.

Specimens cited: Summit of Cathedral Cliffs, *Brooks* 3162; Salt Ridge on white oak, *Brooks* 3237; Gaerky Creek on dry boulder, *Brooks* 3280; Horseshoe Wildlife Area along Scotch Creek on rock along creek, *Brooks* 3385; decommissioned road 0.5 mi W of Buck Rock, *Brooks* 3493; 2 mi NW of Agate Flat along Skookum Creek on dry rock, *Brooks* 3753; 450 ft NW of Big Lake Fen on trunk of *Acer macrophyllum* Pursh in canopy gap, *Brooks* 4318; downstream of Lost Creek Falls on N side of creek on large rock wall, *Brooks* 4433; along Lost Creek on side of large boulder S of lake, *Brooks* 4537.

Antitrichia curtispindula (Hedw.) Brid. (Leucodontaceae). Trunks and branches of hardwoods or on rock.

Specimens cited: Downstream of Lost Creek Falls on N side on branch of *Corylus*, *Brooks* 4441; 0.5 mi SE of Lost Lake on rock pile near small subpeak in mixed conifer forest, *Brooks* 4514.

Atrichum selwynii Austin (Polytrichaceae). On open to shaded soil or soil over rock.

Specimen cited: Just W of Lost Creek Falls on rock slab along trail, *Brooks* 4425.

Aulacomnium androgynum (Hedw.) Schwägr. (Aulacomniaceae). On soil, rotting logs, soil over rock from low to moderate elevations.

Specimens cited: Vicinity of Keene Creek in dry forest on boulder, *Brooks* 3119; 1 mi S of Pilot Rock in mixed conifer stand on downed log, *Brooks* 3556; small seasonal seep in mixed conifer forest on downed branch, *Brooks* 3656; Keno Access Rd and Buck Lake Rd intersection on downed wood in wet rivulet, *Brooks & Shevock* 3854; just W of Lost Creek Falls on rock slab along trail, *Brooks* 4424.

Aulacomnium palustre (Hedw.) Schwägr. (Aulacomniaceae). Wet habitats on moist to wet mineral soil, wood, or rock from mid to high elevations.

Specimens cited: 1 mi N of Hyatt Lake in rocky meadow, *Brooks & Shevock* 3841; on log above small pond just N of Big Lake, *Brooks* 4291; 0.5 mi NW of Big Lake within Quarter Corner Bog among Sphagnum on soil, *Brooks* 4327; Parsnip Lakes at southern most lake on W edge of sedge meadow on rotten log *Brooks* 4347.

Barbula convoluta Hedw. (Pottiaceae). Soil or rock in open disturbed sites.

Specimen cited: Uppermost headwaters of Dead Indian Creek, *Wagner* 9964 (OSC).

Brachytheciastrum collinum (Schleich. ex Müll.Hal.) Ignatov & Huttunen (Brachytheciaceae). Soil, rock from xeric to mesic habitats.

Specimen cited: Along the summit ridge of Surveyor Mountain, *Shevock & Brooks* 56737.

Brachytheciastrum leibergii (Grout) Ignatov & Huttunen (Brachytheciaceae). Soil, humus, litter, and wood from mid to high elevations.

Specimens cited: 1.5 mi W of Howard Prairie Lake along un-named dirt road in mixed conifer forest, *Brooks* 3923; 0.25 mi E of Big Lake on steep forested slope in mixed conifer forest on base of Douglas fir, *Brooks* 4288.

Brachytheciastrum velutinum (Hedw.) Ignatov & Huttunen (Brachytheciaceae). Shaded boulders and rock outcrops from low to high elevations.

Specimens cited: Colestin Valley on S-facing rock outcrop, *Brooks* 2024*; Keno Access Rd and Buck Lake Rd intersection on dry rock, *Brooks & Shevock* 3866; 0.8 mi SW of Old Baldy Mountain and just S of un-named peak at base of summit among large boulders, *Brooks* 4374; 0.5 mi W of Green Springs Mountain and just below ridgeline at base of rock outcrop, *Brooks* 4627.

Brachythecium albicans (Hedw.) Schimp. (Brachytheciaceae). On soil, bark, or rock from low to high elevations.

Specimens cited: 0.25 mi S of Pilot Rock near small peak on small outcrop, *Brooks* 3328; 1 mi WSW of Pilot Rock in mixed juniper/oak near dry ephemeral drainage on base of white oak, *Brooks* 3561; 0.25 mi E of Big Lake on steep forested slope in mixed conifer forest on base of Douglas fir, *Brooks* 4289; along decommissioned road to Parsnip Lakes, *Brooks* 4349; 0.5 mi SE of Round Mountain below closed BLM road in forest opening on boulders, *Brooks* 4470; 1300 ft W of Lost Creek Falls on boulder in conifer forest, *Brooks* 4511.

Brachythecium asperrimum (Mitt. ex Müll.Hal.) Sull. (Brachytheciaceae). Soil, rotten logs, tree trunks and lower branches from low to high elevations.

Specimens cited: 1000 ft W of Big Lake Fen along small creek on small branch, *Brooks* 4326; 650 ft E of Lost Creek Falls on small boulder in stream channel, *Brooks* 4402; just W of Lost Creek Falls on rock slab along trail, *Brooks* 4426.

Brachythecium frigidum (Müll.Hal.) Besch. (Brachytheciaceae). Springs, seeps, and streams from mid to high elevations.

Specimens cited: Bank of Keene Creek, *Brooks* 3115; Baldy Creek Rd in small seasonal seep in mixed conifer forest on soil, *Brooks* 3653; on boulder in splash zone of Dutch Oven Creek, *Brooks* 3674; Lost Creek Falls on rock slab at base of waterfall in shade, *Brooks* 4112; 650 ft E of Lost Creek Falls on small boulder in stream channel, *Brooks* 4398; on rock slab next to Emigrant Creek Falls, *Brooks* 4674.

Bruchia bolanderi Lesq. (Bruchiaceae). Vernally moist soil from mid to high elevations. Though many records exist for this ephemeral in the High Cascades, it remains relatively rare and difficult to detect. Search efforts for this species should focus on mid to high elevation wetlands, usually on the edges

of ephemeral pools or seasonal drainages on exposed soil in areas with little competition from other plants. Specimen cited: Near Surveyor Mountain and just S of Keno Access Rd in wet meadow on soil, *Brooks* 3945.

Bryum argenteum Hedw. (Bryaceae). Exposed soil or rock. This species, often associated with developed habitats is easily recognizable by small julaceous shoots that can be white, gold or white-green. Specimens cited: Colestin Valley on S-facing rock outcrop along ridge, *Brooks* 2023*; along Hwy 99 on W-facing outcrop near state line, *Brooks* 4502; on S-facing rock slab on grassy slope above Lost Creek Canyon, *Brooks* 4521.

Bryum calobryoides J.R.Spence (Bryaceae). Damp soil or rock from moderate to high elevations. Few records for this species are reported for Oregon though at least three of them occur in or around the CSNM. Spence (1986) first encountered this moss in the Olympic Mountains in Washington on a basaltic outcrop at high elevation. In southern Oregon, the habitat is similar to that of the initial discovery and surveys for this species should concentrate on basaltic outcrops from mid to high elevations from wet to dry areas.

Specimens cited: 0.25 mi S of Pilot Rock near small peak on outcrop, *Brooks* 3329; W of Dead Indian Creek headwaters 11 mi ENE of Ashland, *Wagner* 9918 (OSC).

Bryum lanatum (P.Beauv.) Brid. (Bryaceae). Soil, soil over rock from low to high elevations. This small *Bryum* is unmistakable due to its tiny size and frosted white appearance.

Specimen cited: 0.25 mi S of Pilot Rock near small peak on small outcrop, *Brooks* 3319.

Bucklandiella affinis (Schleich. ex F.Weber & D.Mohr) Bedn.-Ochyra & Ochyra (Grimmiaceae). Shaded rock sometimes near water.

Specimens cited: Above Camp Creek on outcrop, *Brooks* 3172; E ridge above Jenny Creek on outcrop, *Brooks* 3288*; Horseshoe Wildlife Area along Scotch Creek on rock along creek, *Brooks* 3386; Keno Access Rd and Buck Lake Rd intersection on dry rock, *Brooks & Shevock* 3865.

Bucklandiella heterosticha (Hedw.) Bedn.-Ochyra & Ochyra (Grimmiaceae). On sunny or shaded boulders of cliffs.

Specimens cited: Along Cottonwood Creek on dry rock, *Brooks* 3140*; above Keene Creek on rock, *Brooks* 3117; 2 mi NW of Agate Flat along Skookum Creek on dry rock, *Brooks* 3754.

Bucklandiella lawtoniae (Ireland) Bedn.-Ochyra & Ochyra (Grimmiaceae). Humid to wet shaded rock on boulders, cliffs or outcrops near streams and waterfalls. This is an extremely rare species, only twice before reported from Oregon by Dan Norris (109452 UC) at the Opal Creek Ancient Forest

Center in Marion County and Hood River County in the Columbia River Gorge near Herman Creek Horse Camp by Wilf Schofield (114458 UBC). It is differentiated from *B. affinis* by having leaves greater than 4mm, a hair point that is entire to slightly denticulate and a seta with a right-handed twist, a character most often associated with the genus *Grimmia*.

Specimen cited: Just W of Lost Creek Falls on rock slab along trail, *Brooks* 4423.

Bucklandiella obesa (Frisvoll) Bedn.-Ochyra & Ochyra (Grimmiaceae). On rock, or soil over rock, from moderate to high elevations. This common species is often robust, forming large open tufts that are typically olive or green in color.

Specimens cited: On boulder in vicinity of Keene Creek, *Brooks* 3118; near Boccard Point on small rock in mixed conifer forest, *Brooks* 3660; Keno Access Rd and Buck Lake Rd intersection in dry rivulet, *Brooks & Shevock* 3856; 1.5 mi W of Howard Prairie Lake along un-named dirt road in mixed conifer forest, *Brooks* 3921; 0.5 mi SE of Round Mountain below closed BLM road in "right fork" drainage on boulder, *Brooks* 4481; 0.5 mi SE of Lost Lake on rock pile near small subpeak in mixed conifer forest, *Brooks* 4516;

Ceratodon purpureus (Hedw.) Brid. (Ditrichaceae). On soil or soil over rock in natural settings or commonly in old roadways from low to high elevations. Both *C. purpureus* and *C. stenocarpus* are morphologically variable and can resemble a species of *Didymodon* often making a field determination difficult. When fertile, the purple seta of *C. purpureus* can help distinguish it from the similar *C. stenocarpus* with a yellowish seta.

Specimens cited: 0.5 mi N. of Randcore Pass on old roadbed, *Brooks* 3343; Horseshoe Wildlife Area along Scotch Creek on rock along creek, *Brooks* 3387; Mariposa Lily Botanical Area 0.7 mi E of Chocolate Falls along seasonal creek on outcrop, *Brooks* 3410; decommissioned road 0.6 mi N of Buck Rock, *Brooks* 3483; 2 mi NW of Agate Flat along Skookum Creek on dry rock, *Brooks* 3755; 1 mi SW of Old Baldy Mountain along BLM road on outcrop, *Brooks* 4362.

Ceratodon stenocarpus Bruch & Schimp. (Ditrichaceae). On soil or soil over rock in natural settings or commonly in old roadways from low to high elevations. See description of *C. purpureus* for notes on distinguishing these similar species.

Specimens cited: In dry rocky meadow above Dutch Oven Creek drainage, *Brooks* 2114; 0.5 mi S of Keene Creek on boulder in clearing, *Brooks* 3133; 0.5 mi N of Randcore Pass in rocky meadow, *Brooks* 3348; 700 ft S of Buck Rock on closed road, *Brooks* 3490; 1 mi S of Pilot Rock in mixed pine/oak on soil and litter, *Brooks* 3558; Surveyor Mountain in deep crevice on wall of boulder, *Brooks & Shevock* 3872.

Claopodium bolanderi Best (Leskeaceae). Rock, soil over rock, from moderate to high elevations. Species of this genus have leaves that are curved in such a way as to resemble a tiny chain making the genus easily distinguishable in the field.

Specimens cited: 300 ft E of small pond N of Big Lake at base of *Acer glabrum* Torr., on soil, *Brooks 4307b*; downstream of Lost Creek Falls on N side of creek on large rock wall, *Brooks 4439*.

Claopodium whippleanum (Sull.) Renauld & Cardot (Leskeaceae). Soil, soil over rock, occasionally wood from low to moderate elevations.

Specimens cited: On S-facing rock outcrop in recess above Lost Creek canyon, *Brooks 4527*; 1000 ft NE of Emigrant Creek Falls in recess of large boulder *Brooks 4656*.

Codriophorus acicularis (Hedw.) P.Beauv. (Grimmiaceae). On wet rock in seasonal or perennial streams at moderate elevations.

Specimen cited: On boulder in Lost Creek 0.25 mi S of Lost Lake, *Brooks 4539*.

Codriophorus depressus (Lesq.) Bedn.-Ochyra & Ochyra (Grimmiaceae). Semi-aquatic on rocks or soil in ephemeral drainages from mid to high elevations. A subalpine rheophytic species that has its major center of distribution in the Sierra Nevada of California (Bednarek-Ochyra 2006). This species was first discovered in Oregon within the Monument in 1998 by David Wagner and since that time very few locations of this species have been found, making it a truly uncommon species in Oregon. Future surveys should focus on areas above 4000 ft in flat meadows within seasonal drainages.

Specimens cited: Keno Access Rd and Buck Lake Rd intersection in small roadside rivulet, *Brooks & Shevock 3851*; uppermost headwaters of Dead Indian Creek, *Wagner 9933* (OSC).

Conardia compacta (Müll.Hal.) H.Rob. (Amblystegiaceae). On moist to wet soil and rock. This species resembles a tiny *Amblystegium* Schimp. and is identifiable from it by the presence of abundant rhizoids that occur on the abaxial costa. This species was not detected within the Monument, however, its location 2.25 mi S of the Monument boundary necessitated its inclusion here, as habitat for it does exist within the Monument.

Specimen cited: Colestin Valley along Cottonwood Creek in calcium rich spring, *Brooks 3147**.

Coscinodon calyptratus (Drumm.) C.E.O.Jensen (Grimmiaceae). Volcanic outcrops in full sun at moderate elevations. This small cushion forming *Grimmia* resembles *G. pulvinata* (Hedw.) Sm. However, the hair points are much longer, and the typically present calyptra covers the entire sporophyte rather than just the operculum. This species is ubiquitous throughout the intermountain west of the United States and is associated with very dry

habitats, however west of the Sierra Nevada and Cascade Mountains, very few records exist.

Specimens cited: Along Hwy 99 on W-facing outcrop 2.2 mi N of state line, *Brooks 4497*; historic collection near Siskiyou Pass, *Schofield 23341* (TENN).

Crumia latifolia (Kindb.) W.B.Schof. (Pottiaceae). Wet areas on rock at low to moderate elevations. Often appearing green or reddish to orange, this species has medium sized spatulate leaves with dark borders caused by enlarged cells at the edge of the leaf.

Specimen cited: SW of Buck Rock Trail parking area in oak woodland in seasonal drainage on small pour over on bedrock, *Brooks 4463*.

Dannorrisia bigelovii (Sull.) Enroth (Neckeraceae). Near streams on wood or rock at moderate elevations. [*Porotrichum bigelovii*].

Specimen cited: 650 ft downstream of Lost Creek Falls on N-facing wall along creek, *Brooks 4449*.

Dendroalsia abietina (Hook). E.Britton ex Broth. (Cryphaeaceae). On bark, wood, or rock from low to mid elevations. As per Norris and Shevock (2004), this species, when dry, is easily recognizable by the frond type leaves that curl downward like a clenched fist. When wet, they are large and fern like.

Specimens cited: Just above Oregon Gulch on black oak trunk, *Brooks & Shevock 3838*; 450 ft NW of Big Lake Fen on trunk of *Acer* in mixed conifer forest, *Brooks 4322*; 1000 ft NW of Lost Creek Falls on S-facing cliff face, *Brooks 4452b*; 0.5 mi SE of Round Mountain below closed BLM road in forest on shaded outcrop, *Brooks 4476*.

Dichelyma uncinatum Mitt. (Fontinalaceae). On tree trunks and branches often near water or inundated from low to moderate elevations. This species is exceedingly rare in California, however, is more common in northern Oregon and the rest of the Pacific Northwest.

Specimen cited: S end of Lost Lake on trunk of *Salix* L., *Brooks 4546*.

Dicranoweisia cirrata (Hedw.) Lindb. ex Milde (Dicranaceae). On the base of tree trunks, rotting logs and occasionally rock. Resembling small pin-cushions, this species is nearly ubiquitous in coniferous forest on the bases of trees and on rotting logs. Specimens cited: Mariposa Lily Botanical Area in oak woodland on downed log in dry drainage, *Brooks 3393*; 1 mi S of Pilot Rock in mixed conifer stand on downed log, *Brooks 3557*; on downed partially burned conifer branch just E of Jenny Creek, *Brooks 4486*; 1300 ft W of Lost Creek Falls on boulder in conifer forest, *Brooks 4513*.

Dicranoweisia crispula—See *Hymenoloma crispulum*

Dicranum howellii Renauld & Cardot (Dicranaceae). Soil, humus, rotting logs, stumps, tree trunks and rock from low to mid elevations.

Specimens cited: 650 ft E of Big Lake on steep forested slope in mixed conifer forest on rotten wood, *Brooks* 4290; 300 ft E of small pond N of Big Lake in pile of boulders on rock, *Brooks* 4306; top of Lost Creek Falls on rock in splash zone, *Brooks* 4413.

Dicranum scoparium Hedw. (Dicranaceae). Soil, humus, rotting logs, stumps, and tree bases, occasionally bogs, fens, and swamps from low to mid elevations.

Specimens cited: 300 ft E of small pond N of Big Lake at base of *Acer glabrum* on soil, *Brooks* 4307a; on boulder just above Lost Creek S of Lost Creek Lake, *Brooks* 4534.

Didymodon cf. brachyphyllus (Sull. ex Whipple) R.H.Zander (Pottiaceae). On soil and rock in wet to dry areas, often in arid climates. Only one location of this species was found within the Monument. However, due to the paucity of the specimen a definite identification was not attainable.

Specimen cited: E branch of Cottonwood Creek near headwaters in oak woodland, *Brooks* 2111.

Didymodon eckeliae R.H.Zander (Pottiaceae). On exposed or slightly shaded dry rock from low to mid elevations. Generally considered rare, this species seems to be much more common than originally thought in Oregon and neighboring California. Its superficial resemblance to *D. vinealis* may be one reason it is under-collected.

Specimens cited: Recess in outcrop on Cathedral Cliffs, *Brooks* 3166; small boulder along Camp Creek, *Brooks* 3183; Salt Ridge near Walker Creek in oak savannah on boulder, *Brooks* 3235; 0.25 mi W of Gaerky Creek in Ashland on outcrop, *Brooks* 3276; just below E ridge above Jenny Creek, *Brooks* 3300*; 0.25 mi S of Pilot Rock near small peak on small outcrop, *Brooks* 3331; Mariposa Lily Botanical Area above seasonal drainage in crevice on large rock outcrop, *Brooks* 3420; 2 mi NW of Agate Flat along Skookum Creek on dry rock, *Brooks* 3747; Oregon Gulch on dry rock outcrop above small seasonal drainage, *Brooks* 3837; 0.75 mi SW of Joe's Rock below road in open rocky meadow deep under rock overhang, *Brooks* 4661.

Didymodon insulanus (DeNot.) M.O.Hill (Pottiaceae). On wet or dry soil over rock along seeps, river corridors or dry forests and meadows from low to mid elevations.

Specimens cited: Alkaline seep along Cottonwood Creek, *Brooks* 3148*; above Keene Creek in dry Ponderosa pine woodland, *Brooks* 3121; on soil in dry exposed meadow in general vicinity of Keene Creek, *Brooks* 3128; just outside of Buck Rock Tunnel on rock wall, *Brooks* 3502; 650 ft E of Lost Creek Falls on small boulder in stream channel, *Brooks* 4399; Emigrant Creek Falls, just above falls on W facing slope above creek on rotting wood, *Brooks* 4642.

Didymodon nicholsonii Culm. (Pottiaceae). On rock or soil over rock in seasonally wet areas, small streams, drainages on outcrops and cliff faces. This semi-rheophytic species is quite common in California, though few collections have been made in Oregon. In the Monument, it occurs along perennial and ephemeral drainages and is likely more common in Oregon than has previously been reported.

Specimens cited: On boulder on the side of Keene Creek 500 ft NE of BLM Rd 40-4e-7, *Brooks* 3105; 0.5 mi N of Randcore Pass in old roadbed, *Brooks* 3342; Horseshoe Wildlife Area along Scotch Creek on slab just above flood plain, *Brooks* 3379; Mariposa Lily Botanical Area 0.7 mi E of Chocolate Falls in seasonal drainage on boulder, *Brooks* 3406; just above Brushy Creek/Scotch Creek confluence on boulder, *Brooks* 3432; 2 mi NW of Agate Flat along Skookum Creek on rock next to pour over, *Brooks* 3741; Oregon Gulch in seepy area on bedrock, *Brooks & Shevock* 3836.

Didymodon norrisii R.H.Zander (Pottiaceae). This species is highly distinctive due to its rusty to red-brown wash and is difficult to overlook once a search image is obtained (Zander 1999). This species prefers full sun in vernal wet or very dry situations, especially over rock slabs.

Specimens cited: Above Scotch Creek on boulder, *Brooks* 3157; 200 ft N of CA/OR border just S of Cathedral Cliffs on rocky summit, *Brooks* 3159; Salt Ridge above Walker Creek at base of white oak on bark, *Brooks* 3250; 0.25 mi W of Gaerky Creek near Ashland, *Brooks* 3269; Horseshoe Wildlife Area along Scotch Creek on S-facing dry outcrop, *Brooks* 3374; in small W-facing meadow 900 ft N of Buck Rock Tunnel, *Brooks* 3492; along Hwy 99 on W-facing outcrop near state line, *Brooks* 4500; on S-facing rock slab on grassy slope above Lost Creek Canyon, *Brooks* 4524; 0.75 mi SW of Joe's Rock below road in open rocky meadow in seasonally wet meadow, *Brooks* 4662.

Didymodon rigidulus Hedw. (Pottiaceae) On open sunny rock from low to mid elevations. This is a small *Didymodon* that often appears as a small nondescript black cushion. This species can be remarkably similar to *D. vinealis* in habit and form and can only be determined through microscopy.

Specimen cited: 0.5 mi NW of Big Lake and just W of Quarter Corner Bog on large boulder in bog, *Brooks* 4328.

Didymodon vinealis (Brid.) R.H.Zander var. *vinealis* (Pottiaceae). On dry and wet soil and rock from low to mid elevations.

Specimens cited: 0.5 mi N of Randcore Pass in rocky meadow, *Brooks* 3351; Scotch Creek on S side on dry N-facing cliff band, *Brooks* 3440; downstream of Lost Creek Falls on N side of creek on large rock wall, *Brooks* 4434.

Didymodon vinealis var. *rubiginosus* (Mitt.) R.H.Zander (Pottiaceae). On dry and wet soil and

rock and occasionally wood, from low to mid elevations.

Specimens cited: Old Hwy 99 in ephemeral drainage in grassland, *Brooks* 3083; 200 ft N of CA/OR border just S of Cathedral Cliffs on rocky summit, *Brooks* 3161; on small boulder along the edge of Camp Creek, *Brooks* 3182; Walker Creek on boulder at high water mark *Brooks* 3256; Horseshoe Wildlife Area along Scotch Creek on slab just above flood plain, *Brooks* 3376; 1 mi N of Fog Rock on base of black oak, *Brooks* 3516; open rocky meadow on rock just above Dutch Oven Creek, *Brooks* 3670; 2 mi NW of Agate Flat along Skookum Creek on base of Oregon ash, *Brooks* 3732a.

Drepanocladus aduncus (Hedw.) Warnst. (Amblystegiaceae). Wetlands, fens, shores, pools, and lakes from low to high elevations.

Specimens cited: Just S of the Lone Pilot Trail in small pond in mixed juniper/oak on soil, *Brooks* 3541; in small muddy depression S of Buck Lake in willow dominated wetland, *Brooks & Shevock* 3883; small pond N of Big Lake on mineral soil on bank, *Brooks* 4297; Parsnip Lakes at N end of second lake from S on downed wood at edge of cattail marsh, *Brooks* 4358; S end of Lost Lake on wet soil near lakes edge, *Brooks* 4552.

Drepanocladus longifolius (Wilson ex Mitt.) Broth. ex Paris (Amblystegiaceae). Lakes, ponds, wet depressions, seasonal pools, springs, creeks, and meadows from low to high elevations. This species is apparently rare or simply under-collected in Oregon with previous records from Klamath and Benton counties. Specimen cited: NW side of Big Lake Fen just upslope on bare soil under *Spiraea* L., *Brooks* 4321b.

Drepanocladus polycarpos (Blandow ex Voit) Warnst. (Amblystegiaceae). Wetlands, fens, shores, pools, and lakes from mid to high elevations. This species is a segregate of the *D. aduncus* complex and is characterized by a much smaller plant with short laminal cells and a weak costa.

Specimens cited: On log above small pond just N of Big Lake Fen, *Brooks* 4293; S end of Big Lake Fen, *Brooks* 4314.

Drepanocladus polygamus (Schimp.) Hedenäs (Amblystegiaceae). Wetlands, fens, shores, pools, and lakes from mid to high elevations.

Specimens cited: Little Hyatt Lake, just below footbridge below dam in Keene Creek, *Brooks* 4179; E side of Big Lake Fen on rotten log in area dominated by sedges, *Brooks* 4316; Parsnip Lakes, southern most lake on W edge of sedge meadow, *Brooks* 4345.

Encalypta ciliata Hedw. (Encalyptaceae). Crevices of rock or on soil in sheltered to exposed areas. This species can be differentiated from the similar *E. procera* by the lack of rhizoidal gemmae on the stems.

Specimen cited: Baldy Creek Rd, 0.5 mi S of Little Pilot Rock on small roadside outcrop, *Brooks* 3652.

Encalypta procera Bruch (Encalyptaceae). Soil and rock, crevices, and ledges. This species was only encountered once within the project and is apparently uncommon within Oregon and neighboring California.

Specimen cited: Along ridge immediately above road and upslope of the dam at Howard Prairie Lake, *Shevock & Brooks* 56765.

Encalypta rhaptocarpa Schwägr. (Encalyptaceae). Soil or soil over rock. The most common member of this species in our area. The leaves have distinct awns, distinguishing it in the field from the other three members of the genus found within the Monument.

Specimens cited: 0.25 mi S of Pilot Rock near small peak on small outcrop, *Brooks* 3317; 0.5 mi N of Randcore Pass in rocky meadow, *Brooks* 3347; just above Brushy Creek/Scotch Creek confluence on boulder, *Brooks* 3439.

Encalypta vulgaris Hedw. (Encalyptaceae). Shallow soil over rock from low to mid elevations. One of the more common members of the genus east of the Cascades however few collections exist within or west of the Cascade divide.

Specimen cited: 0.75 miles SW of Joes Rock below road in open meadow/rock outcrop complex, *Brooks* 4660.

Fissidens crispus Mont. (Fissidentaceae). Moist shaded soil, soil over rocks, often near streams. Specimens cited: E of Howard Prairie Lake Dam along road on dry rock outcrop, *Brooks* 3885; in grassy area under small boulder above Lost Creek canyon, *Brooks* 4530.

Fissidens ventricosus Lesq. (Fissidentaceae). On rock in rapidly running streams.

Specimen cited: Downstream of Lost Creek Falls on boulder in Lost Creek in full shade, *Brooks* 4427.

Fontinalis antipyretica Hedw. (Fontinalaceae). Wood, soil, and rock in vernal or perennially wet habitats from low to high elevations.

Specimens cited: Oregon Gulch in small ephemeral creek on rock and soil, *Brooks & Shevock* 3828; S end of Lost Lake on soil and downed tree trunk, *Brooks* 4551.

Fontinalis howellii Renauld & Cardot (Fontinalaceae). On wood or rock in wet areas that are often seasonally dry from low to moderate elevations.

Specimens cited: 2 mi NW of Agate Flat along Skookum Creek on rock, *Brooks* 3732b; 0.5 mi NW of Big Lake and just W of Quarter Corner Bog on large boulder in bog, *Brooks* 4336.

Fontinalis hypnoides Hartm. (Fontinalaceae). Trees, roots, sticks, ponds, and lakes from mid to high elevations. This species is distinct in not

having sharply keeled leaves and, according to McCune and Hutton (2018), rare in the Pacific Northwest.

Specimens cited: Parsnip Lake at second lake from the S on downed branch at southern edge of wetland, *Brooks* 4343; S end of Lost Lake on trunk of *Salix*, *Brooks* 4545.

Fontinalis neomexicana Sull. & Lesq. (Fontinalaceae). On rock or wood in streams at mid elevations. Easily recognizable in the field by leaves that are perfectly imbricate and aligned to make three-angled shoot tips that form a triangle in cross-section.

Specimen cited: Downstream of Lost Creek Falls on boulder in creek in full shade, *Brooks* 4428.

Funaria hygrometrica Hedw. (Funariaceae). Typically on soil, gravel or occasionally rock, this species forms extensive populations in burned areas. One of the most common mosses globally, this species is recognizable by its bright orange seta that is twisted and forms large populations on bare soil following fire.

Specimens cited: Old roadbed near Gaerky Creek Ashland, *Brooks* 3266; along Scotch Creek in burned area on soil, *Brooks* 3425; 0.5 mi W of Pilot Rock along trail just above small swale on gravel, *Brooks* 3535; just E of Howard Prairie Lake Dam along road on soil and rock, *Brooks & Shevock* 3887.

Gemmabryum caespitium (Hedw.) J.R.Spence (Bryaceae). Disturbed soil, banks, rotten wood and rock, often in disturbed habitats form low to high elevations.

Specimen cited: 0.5 mi NW of Big Lake and just W of Quarter Corner Bog on large boulder in bog, *Brooks* 4329.

Gemmabryum dichotomum (Hedw.) J.R.Spence & H.P.Ramsay (Bryaceae). Dry to moist soil, or soil over rock from low to high elevations.

Specimens cited: Hollenbeck Environmental Study Area, at junction of Conde Creek Road and Dead Indian Memorial Road; 11 mi NE of Ashland, *Wagner m0224* (OSC); Divide W of Dead Indian Creek headwaters ca. 11 mi ENE of Ashland, *Wagner 9920* (OSC).

Gemmabryum vinosum J.R.Spence & Kellman (Bryaceae). On sedimentary or volcanic rock at lower elevations. This small plant is often identifiable in the field by its wine-colored leaves and small stature.

Specimens cited: Salt Ridge on boulder along Dead Indian Memorial Hwy, *Brooks* 3230; Horseshoe Wildlife Area just above Scotch Creek on dry rock outcrop in recess, *Brooks* 3390; Mariposa Lily Botanical Area above seasonal drainage on top of large rock outcrop, *Brooks* 3422.

Grimmia alpestris (F.Weber & D.Mohr) Schleich. (Grimmiaceae). On rock in full sun at mid to high elevations.

Specimens cited: 0.25 mi S of Pilot Rock near small peak on small outcrop, *Brooks* 3316; 0.5 mi N. of Randcore Pass in oak/juniper woodland on boulder, *Brooks* 3346; Horseshoe Wildlife Area just above Scotch Creek on dry rock outcrop in recess, *Brooks* 3391; 1 mi WSW of Pilot Rock on dry rock, *Brooks* 3570; 0.75 mi N of Soda Mountain along road in meadow on large boulder, *Brooks* 3767; 1 mi N of Hyatt Lake along BLM road in rocky meadow, *Brooks & Shevock* 3847; Surveyor Mountain on wall of boulder, *Brooks & Shevock* 3873.

Grimmia anomala Hampe ex Schimp. (Grimmiaceae). Exposed damp acidic rock from mid to high elevations. This unique *Grimmia* generally lacks sporophytes and is identifiable in the field by looking at the leaf tips with a hand lens and searching for clusters of gemmae that decorate some of the leaf tips.

Specimen cited: 1 mi N of Hyatt Lake along BLM road in rocky meadow, *Brooks & Shevock* 3845.

Grimmia attenuata (Müll.Hal. & Kindb.) Kindb. (Grimmiaceae). Dry boulders from low to mid elevations. This species was first discovered in Oregon in 2020 by the author in Douglas County, Oregon near Camas Valley (*Brooks* 3527). One month after that discovery it was collected by the author in the Monument near Howard Prairie Lake. It is hypothesized by the author that the resemblance of this species to *Grimmia leibergii* is responsible for the lack of collections, though it is unclear whether this species is common in Oregon.

Specimen cited: 0.75 mi SE of Howard Prairie Lake above Soda Creek on large outcrop, *Brooks & Shevock* 3889.

Grimmia caespiticia (Brid.) Jur. (Grimmiaceae). Exposed, dry to moist acidic boulders from mid to high elevations. This species is infrequently collected in Oregon and subsequently has few records. This species forms relatively small blue green to blackish green cushions with leaves short awned or muticous. Specimens cited: Near Boccard Point on small rock in mixed conifer forest, *Brooks* 3662; Surveyor Mountain on N-facing boulder field on wall of boulder, *Brooks & Shevock* 3871.

Grimmia laevigata (Brid.) Brid. (Grimmiaceae). Dry rock in exposed sites. This small *Grimmia* is common in the drier parts of the Monument and forms large black hoary populations on rock. Specimens cited: Lone Pine Ridge on outcrop, *Brooks* 3177; Salt Ridge on boulder, *Brooks* 3228; boulders near Gaerky Creek, Ashland, *Brooks* 3267; E ridgeline above Jenny Creek on boulder, *Brooks* 3312*; just above Brushy Creek/Scotch Creek confluence on boulder, *Brooks* 3438.

Grimmia leibergii Paris (Grimmiaceae). On shaded boulders and cliff faces.

Specimens cited: Summit of Cathedral Cliffs, *Brooks* 3164; above Jenny Creek in oak/juniper on boulder,

*Brooks 3201**; large talus field above Jenny Creek, *Brooks 3223**; on E ridge above Jenny Creek, *Brooks 3290**; just above Brushy Creek/Scotch Creek confluence on boulder, *Brooks 3437*; 0.5 mi SE of Round Mountain below closed BLM road in forest opening on boulders, *Brooks 4471*.

Grimmia lisae DeNot. (Grimmiaceae). On exposed to shaded rock faces and boulders at moderate elevations. This species of dry rock is common in nearby coastal California and in the Sierra Nevada, with a handful of locations known from Oregon. Its superficial resemblance to *G. trichophylla* in the field has most likely led to its under-reporting.

Specimens cited: Colestin Valley, 550 ft N of Soda Spring on boulder in flood plain of Cottonwood Creek, *Brooks 3139**; 0.5 mi SE of Round Mountain below closed BLM road in forest on shaded boulder, *Brooks 4475*.

Grimmia montana Bruch & Schimp. (Grimmiaceae). On dry exposed rock at mid to high elevations.

Specimens cited: 0.25 mi S of Pilot Rock near small peak on small outcrop, *Brooks 3313*; 0.5 mi W of Pilot Rock in mixed conifer forest on soil, *Brooks 3540*; 0.75 mi N of Soda Mountain along road in meadow on large boulder, *Brooks 3768*; Surveyor Mountain in N-facing boulder field in deep recess, *Brooks & Shevock 3876*; 0.8 mi SW of Old Baldy Mountain and just S of un-named peak at base of summit among large boulders, *Brooks 4372*; along Hwy 99 on W-facing outcrop near state line, *Brooks 4501*.

Grimmia ovalis (Hedw.) Lindb. (Grimmiaceae). Shaded or exposed boulders and rock outcrops from low to high elevations.

Specimens cited: N of Scotch Creek on rock, *Brooks 3156*; 0.25 mi S of Pilot Rock near small peak on small outcrop, *Brooks 3318*; Horseshoe Wildlife Area along Scotch Creek on dry exposed outcrop, *Brooks 3372*; 1 mi WSW of Pilot Rock on rock, *Brooks 3568*; Baldy Creek Rd 0.5 mi S of Little Pilot Rock on outcrop, *Brooks 3635*; 0.8 mi SW of Old Baldy Mountain and just S of un-named peak at base of summit among large boulders, *Brooks 4370*; on small W-facing dry outcrop within mixed conifer forest just E of Jenny Creek, *Brooks 4485*; on S-facing rock slab on grassy slope above Lost Creek Canyon, *Brooks 4522*.

Grimmia pulvinata (Hedw.) Sm. (Grimmiaceae). On exposed to shaded rock.

Specimens cited: Just E of old Hwy 99 in ephemeral drainage in grassland on boulder, *Brooks 3086*; Salt Ridge along ephemeral drainage near Dead Indian Memorial Hwy, *Brooks 3244*; Mariposa Lily Botanical Area in ephemeral drainage on small boulder, *Brooks 3402*; 2 mi NW of Agate Flat along Skookum Creek on dry rock, *Brooks 3756*.

Grimmia ramondii (DC.) Margad. (Grimmiaceae). On shaded rock from mid to high elevations. Our

most common large statured *Grimmia*. This species has two protrusions or 'wings' that protrude from the abaxial costa forming two distinct dark lines that can be seen with a hand lens in the field.

Specimens cited: Above Dutch Oven Creek drainage on outcrop, *Brooks 2116*; Baldy Creek Rd 0.5 mi S of Little Pilot Rock on small roadside outcrop, *Brooks 3639*; rocky opening in mixed conifer forest on boulder, *Brooks 3658*; Soda Mountain Wilderness on dry boulder, *Brooks & Shevock 3826*; 1 mi N of Hyatt Lake along BLM road in rocky meadow, *Brooks & Shevock 3848*; Surveyor Mountain on N-facing boulder field in deep recess, *Brooks & Shevock 3878*; 0.25 mi E of Big Lake on steep forested slope in mixed conifer forest on rock, *Brooks 4285*; just W of Lost Creek Falls on rock slab along trail, *Brooks 4421*; Emigrant Creek, 750 ft N of falls on large boulder in creek, *Brooks 4651*.

Grimmia torquata Drumm. (Grimmiaceae). On rock at mid to high elevations. This species has the habit and habitat preference of *Amphidium* Schimp., however it can be separated from the former in the field by the presence of small awns that can be viewed with a hand lens and when viewed from the top, the leaves curve in such a way to form small pinwheels. Specimens cited: 0.25 mi W of Gaerky Creek in Ashland on base of boulder, *Brooks 3272*; 0.25 mi S of Pilot Rock near small peak on small outcrop, *Brooks 3332*; on S-facing rock outcrop in recess above Lost Creek Canyon, *Brooks 4528*.

Grimmia trichophylla Grev. (Grimmiaceae). On exposed rock from low to mid elevations. Specimens cited: Dry meadow near Keene Creek, *Brooks 3116*; boulder along Camp Creek, *Brooks 3185*; Salt Ridge on boulder, *Brooks 3229*; 0.25 mi W of Gaerky Creek on rock slab, Ashland, *Brooks 3270*; 0.5 mi N of Randcore Pass in rocky meadow, *Brooks 3354*; Mariposa Lily Botanical Area 0.7 mi E of Chocolate Falls above seasonal creek, *Brooks 3409*; just above Brushy Creek/Scotch Creek confluence on boulder, *Brooks 3431*; just outside of Buck Rock Tunnel on rock wall, *Brooks 3498*; Baldy Creek Rd 0.5 mi S of Little Pilot Rock on small roadside outcrop, *Brooks 3646*; 2 mi NW of Agate Flat along Skookum Creek on rock, *Brooks 3736b*; 0.5 mi SE of Lost Lake on rock pile near small subpeak in mixed conifer forest, *Brooks 4518*.

Hamatocaulis vernicosus (Mitt.) Hedenäs (Calliergonaceae). Mineral rich spring-influenced habitats from low to moderate elevations.

Specimen cited: On sippy peat at EW-NS bend in northside short statured fen community at SW Buck Lake, *Dewey 070914-1449*.

Herzogiella seligeri (Brid.) Z.Iwats. (Hypnaceae). In conifer woods on rotten logs, bases of trees from moderate to high elevations.

Specimens cited: Downstream of Lost Creek Falls on rotten log along creek, *Brooks 4443*; 1 mi below Conde Creek Rd on well-decayed wood, *Wagner*

m0361 (DUKE); on rotten log just above Lost Creek S of lake, *Brooks 4533*.

Homalothecium aeneum (Mitt.) E.Lawton (Brachytheciaceae). On rock or wood from low to high elevations.

Specimens cited: Below E ridgeline above Jenny Creek, *Brooks 3304**; Mariposa Lily Botanical Area 0.7 mi E of Chocolate Falls along seasonal creek on outcrop, *Brooks 3414*; 2 mi NW of Agate Flat along Skookum Creek on dry rock, *Brooks 3754a*.

Homalothecium fulgens (Mitt. ex Müll.Hal.) A.Jaeger (Brachytheciaceae). Tree trunks, fallen logs and rock in moderate shade at all elevations.

Specimens cited: Walker Creek on boulder in splash zone, *Brooks 3253*; E of Howard Prairie Lake Dam along road on rock outcrop, *Brooks & Shevock 3886*; on rotten log just above Lost Creek S of lake, *Brooks 4536*.

Homalothecium nevadense (Lesq.) Renauld & Cardot (Brachytheciaceae). Shaded rock or occasionally tree bases in dry or wet habitats from low to high elevation.

Specimens cited: Along Cottonwood Creek on rock, *Brooks 3145*; on boulder along Camp Creek, *Brooks 3178*; Walker Creek on rock along the creek, *Brooks 3261*; 0.25 mi S of Pilot Rock near small peak on small outcrop, *Brooks 3326*; 0.5 N of Randcore Pass in rocky meadow, *Brooks 3350*; Mariposa Lily Botanical Area in oak savannah on base of oak, *Brooks 3394*; 0.75 mi N of Soda Mountain along road in meadow on large boulder, *Brooks 3774*; 1.75 mi W of Howard Prairie Lake along un-named dirt road, *Brooks & Shevock 3925*; 1300 ft W of Lost Creek Falls on boulder in conifer forest, *Brooks 4512*; Emigrant Creek Falls, 50 ft S of falls on branch of Pacific yew along creek *Brooks 4648*.

Homalothecium nuttallii (Wilson) A.Jaeger (Brachytheciaceae). Epiphytic on the trunks or branches of trees or occasionally on rock.

Specimens cited: Vicinity of Keene Creek on boulder in clearing, *Brooks 3131*; 0.25 mi E and upslope of Lost Lake on large, shaded outcrop, *Brooks 4548*.

Homalothecium pinnatifidum (Sull. & Lesq.) E.Lawton (Brachytheciaceae). Soil, soil over rock, boulders, or cliffs.

Specimens cited: Salt Ridge on boulder along Dead Indian Memorial Hwy, *Brooks 3231*; just outside of Buck Rock Tunnel on rock wall, *Brooks 3508*; 1 mi N of Fog Rock on base of black oak, *Brooks 3514*; Baldy Creek Rd 0.5 mi S of Little Pilot Rock on small roadside outcrop, *Brooks 3638*.

Hylocomiadelphus triquetrus (Hedw.) Ochyra & Stebel (Hylocomiaceae). Soil, humus, occasionally logs or rock from low to high elevations. [*Rhytidia-delphus triquetrus*].

Specimens cited: 300 ft E of small pond N of Big Lake on soil, *Brooks 4310*; 650 ft E of Lost Creek

Falls on creek bank in full shade, *Brooks 4405*; Emigrant Creek Falls, 50 ft S of falls on soil and duff *Brooks 4644*.

Hylocomium splendens (Hedw.) Schimp. (Hylocomiaceae). On soil or soil over rock or litter from low to moderate elevations.

Specimens cited: 0.25 mi S of Lost Creek Lake along N-facing creek bank, *Brooks 4541*; Along Emigrant Creek at base of small falls on litter, *Brooks 4638*; Emigrant Creek Falls on soil at base of falls *Brooks 4638*.

Hymenoloma crispulum (Hedw.) Ochyra (Hymenolomataceae). On rock or gravel from mid to high elevations. [*Dicranoweisia crispula*].

Specimens cited: 1 mi N of Hyatt Lake in rocky meadow, *Brooks & Shevock 3841*; Keno Access Rd and Buck Lake Rd intersection on dry rock, *Brooks & Shevock 3863*; Surveyor Mountain on N-facing boulder field in deep recess, *Brooks & Shevock 3877*; E of Howard Prairie Lake Dam along road on rock outcrop, *Brooks & Shevock 3884*; 0.8 mi SW of Old Baldy Mountain and just S of un-named peak near summit on large rock wall, *Brooks 4380*.

Hypnum circinale—See *Trochophyllohypnum circinale*
Hypnum subimponens—See *Stereodon subimponens*

Imbribryum alpinum (Huds. ex With.) N.Pedersen (Bryaceae). Moist acidic rock, soil over rock from low to high elevations. This species is apparently rare or under-collected in Oregon with only two previous state records.

Specimen cited: 0.75 mi N of Soda Mountain along road in meadow on large boulder, *Brooks 3777*.

Imbribryum gemmiparum (DeNot.) J.R.Spence (Bryaceae). Damp to wet calcareous soil, soil over rock from low to high elevations.

Specimens cited: Headwaters of Dead Indian Creek on rock in streambed, *Wagner 9932* (OSC); hill at W corner of Conde Creek drainage along jeep track, *Wagner m0318* (OSC).

Imbribryum cf. mildeanum (Jur.) J.R.Spence (Bryaceae). Damp soil along streams, wetlands, low to high elevations. The specimen cited here most closely resembles this species, however more research and collections are needed from both California and Oregon to better understand this species within the California Floristic Province (Jim Shevock, CAS, personal communication).

Specimen cited: 2 mi NW of Agate Flat along Skookum Creek on rock next to pour over, *Brooks 3743*.

Imbribryum miniatum (Lesq.) J.R.Spence (Bryaceae). Damp to wet rock, soil over rock, waterfalls, and springs from low to mid elevations. One of the more handsome species in the Monument, the leaves are bright red or occasionally metallic gold.

Specimens cited: 2 mi NW of Agate Flat along Skookum Creek on rock next to pour over, *Brooks*

3739; Oregon Gulch in small stream channel, *Brooks & Shevock* 3831; just above Lost Creek Falls in dry ephemeral side creek on bedrock, *Brooks* 4460.

Imbriobryum torenii J.R.Spence & Shevock (Bryaceae). On soil, soil over rock, or rock in open sites with runoff at low to moderate elevations. This recently described species by Spence and Shevock (2015) has very few records in Oregon and its distribution in the state is not well understood.

Specimens cited: Along Camp Creek, *Brooks* 3184; 0.5 mi N. of Randcore Pass in old roadbed, *Brooks* 3341; just outside of Buck Rock Tunnel on rock wall, *Brooks* 3506; near Boccard Point in open rocky meadow on rock, *Brooks* 3671; 0.75 mi N of Soda Mountain along road in meadow on large boulder, *Brooks* 3775; on S-facing rock outcrop above Lost Creek Canyon, *Brooks* 4526a; 0.75 mi SW of Joes Rock below road in open rocky meadow on outcrop, *Brooks* 4659.

Isothecium cristatum (Hampe) H.Rob. (Lembophyllaceae). Epiphytic or on rock at low to high elevations.

Specimen cited: 0.5 mi SE of Round Mountain below closed BLM road in forest opening on boulders, *Brooks* 4473.

Isothecium stoloniferum Brid. (Lembophyllaceae). Epiphytic on trees and shrubs or on rock from low to moderate elevations.

Specimens cited: Lost Creek Falls on rock slab at base of waterfall in shade, *Brooks* 4113; 650 ft E of Lost Creek Falls on creek bank in full shade, *Brooks* 4407; 1000 ft NE of Emigrant Creek Falls on large boulder, *Brooks* 4654.

Kindbergia oregana (Sull.) Ochyra (Brachytheciaceae). Litter, soil, humus, rotten logs from low to moderate elevations. Possibly the most common bryophyte species in the West Cascades, however, it is less frequently encountered in the Monument.

Specimen cited: 450 ft NW of Big Lake Fen on soil in mixed conifer forest, *Brooks* 4321.

Kindbergia praelonga (Hedw.) Ochyra (Brachytheciaceae). On soil in wet to mesic forested habitats from mid to high elevations.

Specimen cited: 650 ft E of Lost Creek Falls on litter along stream channel, *Brooks* 4403.

Leptobryum pyriforme (Hedw.) Wilson (Meesiaceae). Soil, wood, rock, disturbed habitats from low to high elevations.

Specimen cited: Little Hyatt Lake on floating log near S shoreline, *Brooks* 4181.

Leptodictyum riparium (Hedw.) Warnst. (Amblystegiaceae). Humus, logs, tree bases, wet depressions, and swamps from low to moderate elevations.

Specimens cited: E side of Big Lake Fen on rotten log in area dominated by sedges, *Brooks* 4315; Parsnip Lakes, southernmost lake on W edge of sedge meadow, *Brooks* 4346.

Leucolepis acanthoneura (Schwägr.) Lindb. (Mniaceae). On moist to wet shaded rocks, soil and tree bases, often along streams.

Specimens cited: 450 ft NW of Big Lake Fen on soil in mixed conifer forest, *Brooks* 4320; top of Lost Creek Falls on rock slab in full shade, *Brooks* 4417; Emigrant Creek Falls, on rock slab directly next to falls *Brooks* 4641.

Lewinskya arida Vigalondo, F.Lara & Garilleti (Orthotrichaceae). Epiphytic on hardwoods in wet or dry habitats at mid to high elevations. This species is a segregate of the *Lewinskya pseudoaffinis* [*Orthotrichum affine*] complex and is differentiated from *L. pseudoaffinis* by a sparsely short hairy calyptra and leaves that are broad at the base but very narrow in the upper part (Vigalondo et al. 2020).

Specimens cited: 2 mi NW of Agate Flat along Skookum Creek on base of Oregon ash, *Brooks* 3731; Oregon Gulch on large boulder near intermittent stream, *Brooks & Shevock* 3832; Parsnip Lake at E end of second lake from S on cottonwood trunk, *Brooks* 4356; 1.45 mi S of Pinehurst Inn on rock along Jenny Creek, *Brooks* 4493; Emigrant Creek on alder branch over creek just below falls, *Brooks* 4649.

Lewinskya holzingeri (Renauld & Cardot) F.Lara, Garilleti & Goffinet (Orthotrichaceae). A rheophytic species found on seasonally wet rock in small streams and ephemeral drainages. [*Orthotrichum holzingeri*]. This species is primarily known in Oregon from the eastern part of the state. It was found many times in the Monument during work for this manuscript and occupies much of the same habitat as that for *Orthotrichum euryphyllum* Vent., with the two species frequently occurring together. It can often be identified in the field by its naked calyptra when present.

Specimens cited: E branch of Cottonwood Creek, *Brooks* 2105; along Jenny Creek on boulder, *Brooks* 3217*; Mariposa Lily Botanical Area 0.7 mi E of Chocolate Falls in seasonal drainage on boulder, *Brooks* 3405; 1 mi N of Fog Rock in un-named drainage on dry rock, *Brooks* 3518; 2 mi NW of Agate Flat along Skookum Creek on rock, *Brooks* 3742.

Lewinskya laevigata (J.E.Zetterst.) F.Lara, Garilleti & Goffinet (Orthotrichaceae). On exposed to shaded rock or wood from low to high elevations [*Orthotrichum laevigatum*]. One of the most common members of the genus in the Monument, identifiable in the field by its long exerted and smooth capsules that are almost always present.

Specimens cited: Salt Ridge just off Dead Indian Memorial Hwy in ephemeral drainage, *Brooks* 3243; Gaerky Creek on dry boulder, Ashland, *Brooks* 3279; 0.25 mi S of Pilot Rock near small peak on small outcrop, *Brooks* 3320; Mariposa Lily Botanical Area 0.7 mi E of Chocolate Falls along seasonal creek on outcrop, *Brooks* 3411; just above Brushy Creek/Scotch creek confluence on boulder, *Brooks*

3430; Baldy Creek Rd 0.5 mi S of Little Pilot Rock on small roadside outcrop, *Brooks* 3644; on boulder in splash zone of Dutch Oven Creek, *Brooks* 3673; 2 mi NW of Agate Flat along Skookum Creek on dry rock in middle of creek, *Brooks* 3737; 0.75 mi N of Soda Mountain along road in meadow on large boulder, *Brooks* 3772.

Lewinskya pseudoaffinis Vigalondo, F.Lara & Garilleti (Orthotrichaceae). On hardwood or conifer bark, often on or near the base of trees. [misapplied as *Orthotrichum affine* Brid. in western North America]. Vigalondo et al. (2020) report that *Lewinskya affinis* is a complex of species with *L. affinis* restricted to Europe and a new name, *L. pseudoaffinis*, applied to the similar North American populations. This species can be separated in the field from its local counterpart *L. arida* by a calyptra with long hairs and capsules that are typically long exerted.

Specimens cited: E of Cottonwood Creek, 0.25 mi N of Soda Spring on base of alder, *Brooks* 3137*; 2 mi NW of Agate Flat along Skookum Creek on branch of Oregon white oak, *Brooks* 3761.

Lewinskya pylaisii (Brid.) F.Lara, Garilleti & Goffinet (Orthotrichaceae). On rock from low to high elevations. [*Orthotrichum pylaisii* Brid.].

Specimen cited: Surveyor Mountain on N-facing boulder field in deep recess, *Brooks & Shevock* 3880.

Lewinskya rupestris (Schleich. ex. Schwägr.) F.Lara, Garilleti & Goffinet (Orthotrichaceae). Non-calcareous boulders and cliffs in mesic areas from low to high elevations [*Orthotrichum rupestre*]. This species is morphologically variable with forms ranging from large plants that have a reddish cast to smaller plants that are much greener to nearly black. This species is almost always fertile with an emergent ribbed capsule.

Specimens cited: Rock above Dutch Oven Creek, *Brooks* 2112; Cathedral Cliffs in recess on rock outcrop, *Brooks* 3167; Salt Ridge just off Dead Indian Memorial Hwy in ephemeral drainage, *Brooks* 3247; Walker Creek on boulder at high water mark, *Brooks* 3255; 0.25 mi S of Pilot Rock near small peak on small outcrop, *Brooks* 3325; Horseshoe Wildlife Area along Scotch Creek above on S-facing dry outcrop, *Brooks* 3375; Mariposa Lily Botanical Area above seasonal drainage on large rock outcrop *Brooks* 3416; along Scotch Creek on boulder in full sun, *Brooks* 3429; just above Brushy Creek/Scotch Creek confluence on boulder, *Brooks* 3434; just outside of Buck Rock Tunnel on rock wall, *Brooks* 3500; 2 mi NW of Agate Flat along Skookum Creek on dry rock, *Brooks* 3748; 0.75 mi SE of Howard Prairie Lake above Soda Creek on large outcrop, *Brooks & Shevock* 3888; on small W-facing talus slope within mixed conifer forest just E of Jenny Creek, *Brooks* 4483; 1.45 mi S of Pinehurst Inn on rock along Jenny Creek, *Brooks* 4492; along Hwy 99 on W-facing outcrop near state line, *Brooks* 4498; on

S-facing rock outcrop above Lost Creek Canyon, *Brooks* 4525.

Meesia longiseta Hedw. (Meesiaceae). Fens from low to high elevations. A distinctive species when encountered in fens due to its very long seta that is between 5–11 cm in length.

Specimen cited: On soil among sedges at small pond just N of Big Lake Fen, *Brooks* 4302.

Meesia triquetra (L. ex Jolycl.) Ångstr. (Meesiaceae). Fens from moderate to high elevations. Highly distinctive when hydrated due to its three-ranked leaves.

Specimens cited: Small pond N of Big Lake Fen in adjoining sedge dominated bog, *Brooks* 4299; central area of Big Lake Fen among sedges, *Brooks* 4301.

Meesia uliginosa Hedw. (Meesiaceae). Fens and soil banks from low to high elevations. Specimens cited: On damp soil over rotten boles on hummock in short statured fen community S of Surveyor Campground, *Dewey* 061314-1014; on damp rotten bole and stump base at SW corner of northside short-statured fen community SW Buck Lake, *Dewey* 070914-1449.

Metaneckera menziesii (Drumm.) Steere (Neckeraaceae). Shaded cliffs and tree trunks at mid elevations. [*Neckera menziesii*].

Specimens cited: Downstream of Lost Creek Falls on N side of creek on large rock wall, *Brooks* 4435; 0.25 mi E and upslope of Lost Lake on large, shaded outcrop, *Brooks* 4547.

Mnium marginatum (Dicks.) P.Beauv. (Mniaceae). Within forests on humus, soil, wood, or shaded cliffs from low to moderate elevations. This species was only collected once within the monument, and to date is the only collection from southern Oregon. It has likely been under collected, or simply misidentified in the past.

Specimen cited: Emigrant Creek Falls. 50 ft S of falls on boulder next to creek *Brooks* 4654.

Mnium spinosum (Voit) Schwägr. (Mniaceae). On humus and soil from low to high elevations.

Specimen cited: 1.3 mi N of Howard Prairie Reservoir, 11 mi ENE of Ashland; ~2 mi down rd 38-3E-11, *Wagner* 9595* (OSC).

Mnium spinulosum Bruch & Schimp. (Mniaceae). Forests, on humus, logs, rock, base of trees from low to moderate elevations.

Specimen cited: Along ridge above road and upslope of dam at Howard Prairie Lake, *Shevock & Brooks* 56755.

Neckera douglasii Hook. (Neckeraceae). On decaying wood, tree trunks and rock from low to moderate elevations.

Specimen cited: Emigrant Creek Falls, 50 ft S of falls on branch of Pacific yew *Brooks* 4643.

Niphotrichum canescens (Hedw.) Bedn.-Ochyra & Ochyra (Grimmiaceae). Sandy or gravelly soils, fine

rock or boulders, often on roadsides. This pilose species is much less common than *Niphotrichum elongatum* in our area. In southern Oregon this species has only this single record though it is possibly under collected in our area.

Specimen cited: Upper headwaters of Dead Indian Creek, 2 mi W of Howard Prairie Reservoir; 13 mi ENE of Ashland; rocky rise 200 ft N of stream channel, *Wagner m0421* (OSC).

Niphotrichum elongatum (Ehrh. ex Frisvoll) Bedn.-Ochyra & Ochyra (Grimmiaceae). Dry gravelly soils or outcrops, roadsides.

Specimen cited: Just W of Lost Creek Falls on rock slab along trail, *Brooks 4419*.

Nyholmiella obtusifolia (Brid.) Holmen & E. Warncke (Orthotrichaceae). Trunks of hardwoods, typically at base, from low to high elevations. [*Orthotrichum obtusifolium*]. This species is unique among other epiphytic Orthotrichaceae in that it has blunt, rounded leaves with leaf margins that are erect or in-rolled.

Specimens cited: Mariposa Lily Botanical Area on base of white oak, *Brooks 3400*; 1 mi N of Fog Rock on base of black oak, *Brooks 3510*.

Orthodicranum tauricum (Sapjegin) Smirnova (Dicranaceae). Rotten logs, stumps, or tree bases.

Specimens cited: 1 mi S of Pilot Rock in mixed conifer stand on downed log, *Brooks 3555*; just above Dutch Oven Creek on base of incense cedar, *Brooks 3676*; Parsnip Lake at second lake from the S on rotten log at southern edge of wetland, *Brooks 4351*. *Orthotrichum affine*—See *Lewinskya pseudoaffinis*

Orthotrichum alpestre Hornsch. ex Bruch & Schimp. (Orthotrichaceae). On volcanic rock. Specimen cited: Base of large cliff E of Jenny Creek near Iron Gate Reservoir, *Brooks 3224**.

Orthotrichum confusum R. Medina, F. Lara & Garilleti (Orthotrichaceae). Tree trunks or branches of hardwoods in shady forests. This species is a member of the *Orthotrichum consimile* complex. In the field, the naked calyptra in *confusum* separates it from *consimile* (Medina et al. 2012).

Specimen cited: Downstream of Lost Creek Falls on N side on branch of *Corylus* L., *Brooks 4440*; 0.25 mi S of Lost Creek Lake along creek on maple branch, *Brooks 4542*.

Orthotrichum cupulatum Hoffm. ex Brid. (Orthotrichaceae). Exposed or shaded rock. Specimen cited: Rock slab above Cottonwood Creek, Colectin Valley, *Brooks 2020**.

Orthotrichum euryphyllum Vent. (Orthotrichaceae). On rock in ephemeral drainages or in the splash zone of larger creeks in full sun. This species is easily identified in the field by its compact stature and leaves that are reddish to purplish or nearly black. This species occurs on rocks in small drainages or perennial creeks, but grows where it can dry out for

at least part of the year. This species is globally rare, and seems to have its main center of distribution in southwest Oregon ranging as far north as Butte Falls, Oregon and west to near Cave Junction, Oregon. However, disjunct populations occur south into California with locations reported on the Modoc Plateau south to Lassen County and into adjacent Nevada.

Specimens cited: Near CA/OR border 0.75 mi E of I-5 in seasonal drainage, *Brooks 2107*; Salt Ridge just off Dead Indian Memorial Hwy N of Ashland in ephemeral drainage, *Brooks 3245*; Horseshoe Wildlife Area along Scotch Creek on slab just above flood plain, *Brooks 3378*; Mariposa Lily Botanical Area in ephemeral drainage on small boulder, *Brooks 3399*; 1 mi N of Fog Rock in un-named drainage on dry rock in oak woodland, *Brooks 3512*.

Orthotrichum holzingeri—See *Lewinskya holzingeri*

Orthotrichum laevigatum—See *Lewinskya laevigata*

Orthotrichum lyellii—See *Pulvigerella lyellii*

Orthotrichum obtusifolium—See *Nyholmiella obtusifolia*

Orthotrichum papillosum—See *Pulvigerella papillosa*

Orthotrichum pylaisii—See *Lewinskya pylaisii*

Orthotrichum rivulare Turner (Orthotrichaceae). On rock in intermittent streams or creeks. Specimens cited: Boulder on side of Keene Creek, *Brooks 3106*; Jenny Creek on boulder in channel, *Brooks 3216**; 650 ft E of Lost Creek Falls on small boulder in stream channel, *Brooks 4401*; on base of alder along Jenny Creek, *Brooks 4488*.

Orthotrichum rupestre—See *Lewinskya rupestris*

Phascum cuspidatum Schreb. ex Hedw. (Pottiaceae). Disturbed areas, lawns, and ditches from low to moderate elevations.

Specimen cited: NW side of Emigrant Lake Recreation Area near playground in lawn area, *Brooks 4623**.

Philonotis americana Dism. (Bartramiaceae). Seeps, ditches, fens, lakes, vernal wet areas, from low to high elevations.

Specimen cited: 0.25 mi SW of Little Pilot Peak in small seasonal seep in mixed conifer forest on soil, *Brooks 3654*.

Philonotis capillaris Lindb. (Bartramiaceae). Wet areas on soil and rock in shady habitats from mid to high elevations.

Specimen cited: 650 ft E of Lost Creek Falls on small boulder in stream channel, *Brooks 4400*.

Philonotis fontana (Hedw.) Brid. (Bartramiaceae). Seeps, ditches, fens, lakes, vernal wet areas, from low to high elevations.

Specimen cited: Near Lone Pilot Trail in ephemeral drainage, *Brooks 3543*; 2 mi NW of Agate Flat along Skookum Creek on rock, *Brooks 3733*; 1.25 mi NE of Soda Mountain along road in seep, *Brooks 3765*; 300 ft above Lost Creek Falls along creek in small

wetland on boulder, *Brooks 4453a*; SW of Buck Rock Trail parking area in oak woodland in seasonal drainage below small pour over on bedrock, *Brooks 4466*; Emigrant Creek Falls, on rock slab directly next to falls *Brooks 4639*.

Physcomitrella readeri (Müll.Hal.) I.G.Stone & G.A.M.Scott (Funariaceae). On mud flats of reservoirs and lake banks. This is the first collection of this species from Oregon and only the third collection in North America. It is possible that this species has been overlooked, especially in reservoirs, as it fruits very early in the spring in areas that become inundated during spring run-off.

Specimen cited: On cracked mud deep in shaded crack of dry lake bed above trickling stream, Emigrant Lake, *Brooks 4533**.

Plagiobryoides sp. (Bryaceae). This is an undescribed, but well-known species that is common in nearby California and awaiting a new name (Jim Shevock, CAS, personal communication).

Specimens cited: 0.5 mi N of Randcore Pass in rocky meadow, *Brooks 3349*; Horseshoe Wildlife Area along Scotch Creek on S-facing dry outcrop, *Brooks 3373*; Horseshoe Wildlife Area along Scotch Creek just above flood plain, *Brooks 3380*.

Plagiomnium insigne (Mitt.) T.J.Kop. (Mniaceae). Humus or soil in shady forests and urban habitats from low to moderate elevations.

Specimens cited: On boulder in splash zone of Dutch Oven Creek, *Brooks 3672*; 650 ft E of Lost Creek Falls on creek bank in full shade, *Brooks 4406*; downstream of Lost Creek Falls on soil along creek, *Brooks 4444*; SW of Buck Rock Trail parking area just above small drainage on litter, *Brooks 4461*; On rock slab next to Emigrant Creek Falls, *Brooks 4677*.

Plagiomnium venustum (Mitt.) T.J.Kop. (Mniaceae). Humus, soil, sand, logs, stumps, tree bases, rock.

Specimens cited: Just outside of Buck Rock Tunnel on rock wall, *Brooks 3505*; 2 mi NW of Agate Flat along Skookum Creek on branch of Oregon white oak, *Brooks 3763*; NW of Big Lake at base of big leaf maple in mixed conifer forest, *Brooks 4323*; downstream of Lost Creek Falls on N side of creek on large rock wall, *Brooks 4436*; 0.5 mi SE of Round Mountain below closed BLM road in "right fork" drainage on boulder, *Brooks 4478*; Emigrant Creek Falls, on rock slab directly next to falls *Brooks 4640*.

Plagiothecium denticulatum (Hedw.) Schimp. (Plagiotheciaceae). On rock or rotting wood from mid to high elevations.

Specimens cited: Just W of Lost Creek Falls on rock slab along trail, *Brooks 4418*; on rock face just above Lost Creek S of lake, *Brooks 4535*; 0.5 mi W of Green Springs Mountain and just below ridgeline at base of rock outcrop, *Brooks 4624*.

Plagiothecium piliferum—See *Rectithecium piliferum*

Pohlia bolanderi (Lesq.) Broth. (Bryaceae). On rock and soil within high elevation outcrops, typically in the crevices of large boulders. This small, cryptic species seems to exclusively occur in craggy situations at high elevations, often associated with mountain peaks. This species is likely common throughout the High Cascades and an absence of surveys from much of this area can account for the lack of records for this species.

Specimens cited: 0.8 mi SW of Old Baldy Mountain and just S of un-named peak near summit among large boulders, *Brooks 4378*; along the summit ridge of Surveyor Mountain, *Shevock & Brooks 56739*.

Pohlia camptotrachela (Renauld & Cardot) Broth. (Bryaceae). Acid, gravely or sandy disturbed soil, path, or stream banks, low to high elevations.

Specimen cited: 1.25 mi NE of Soda Mountain along road in seep, *Brooks 3765a*.

Pohlia cruda (Hedw.) Lindb. (Bryaceae). Soil banks, rock crevices from mid to high elevations. Specimens cited: Along small creek S of Buck Lake in willow dominated wetland, *Brooks 3882*; 0.8 mi SW of Old Baldy Mountain and just S of un-named peak on NE side of summit ridge in narrow seasonal pour over on rock, *Brooks 4392*; top of Lost Creek Falls on rock in splash zone, *Brooks 4064*; 0.5 mi SE of Round Mountain below closed BLM road in forest opening under boulder, *Brooks 4474*.

Pohlia drummondii (Müll.Hal.) A.L.Andrews (Bryaceae). Humus rich soil, stream banks, paths, low to high elevations.

Specimen cited: Surveyor Mountain in N-facing boulder field on soil over rock, *Brooks & Shevock 3875*.

Polytrichum juniperinum Hedw. (Polytrichaceae). Exposed soils in open woods on trail sides, road banks, and road cuts, soil over rocks, low to high elevations.

Specimens cited: 1 mi N of Hyatt Lake along BLM road in rocky meadow, *Brooks & Shevock 3844*; Keno Access Rd and Buck Lake Rd intersection on soil, *Brooks & Shevock 3857*; Little Hyatt Lake on floating log near S shoreline, *Brooks 4180*; just W of Lost Creek Falls on rock slab along trail, *Brooks 4422*.

Polytrichum piliferum Hedw. (Polytrichaceae). Well drained soils over rock from low to high elevations. Specimens cited: 2 mi NW of Agate Flat along Skookum Creek on dry rock, *Brooks 3749*; 1 mi N of Hyatt Lake in rocky meadow, *Brooks & Shevock 3840*; 0.75 mi SE of Howard Prairie Lake above Soda Creek in recess of outcrop on soil over litter, *Brooks & Shevock 3891*; just W of Lost Creek Falls on rock slab along trail, *Brooks 4420*; along 40-4e-4 road S of Pinehurst Inn, *Brooks 4494*; on rock pile in canopy gap overlooking Lost Creek Canyon, *Brooks 4519*.

Pseudobraunia californica (Lesq.) Broth. (Hedwigiaceae). On dry rock in partial or direct sun. Specimens cited: Horseshoe Wildlife Area near old home site on dry rock outcrop, *Brooks* 3388; 0.5 mi SE of Round Mountain below closed BLM road in forest opening on boulders, *Brooks* 4469.

Pseudocalliergon angustifolium Hedenäs (Amblystegiaceae). Forested to open habitats in fens at mid elevations. This species is reported here as new for Oregon. Appearing much like *Drepanocladus* in the field and growing among members of the genus, it is distinguishable microscopically by a lack of differentiated alar cells. It is possible this species occurs in similar habitats within the Monument, such as Tunnel Creek Wetlands. However, its cryptic nature among many look alike members of the family makes for difficult detection.

Specimen cited: S central side of Big Lake Fen on soil in area dominated by sedges, *Brooks* 4317.

Pseudocrossidium hornschruchianum (Schultz) R.H.Zander. (Pottiaceae). On rocky substrates from low to high elevations. This species is extremely cryptic, difficult to detect and rarely encountered. In North America, Zander (1993) reports this species is found in association with parks and gardens and determines that it has most likely been distributed globally by human activity. Ironically, the first site of this species in Oregon was found in a natural setting on a ridgetop in the Applegate Valley in Ferris Gulch by David Wagner (*Wagner*, 9183, MO).

Specimen cited: In old roadbed within oak savannah near Gaerky Creek, Ashland, *Brooks* 3278.

Pseudoleskea incurvata (Hedw.) Loeske (Leskeaceae). Dry rock, mineral soil; moderate to high elevations. Specimen cited: Along summit ridge of Surveyor Mountain on large boulder, *Shevock & Brooks* 56735.

Pseudoleskea patens (Lindb.) Kindb. (Leskeaceae). Shaded to exposed rock and outcrops, also soil moderate to high elevations.

Specimens cited: Near Boccard Point on small rock in mixed conifer forest, *Brooks* 3659; Keno Access Rd and Buck Lake Rd intersection in dry rivulet, *Brooks & Shevock* 3853b; 1.75 mi W of Howard Prairie Lake along un-named dirt road in mixed conifer forest, *Brooks & Shevock* 3922; 0.25 mi E of Big Lake on steep forested slope in mixed conifer forest on soil over rock, *Brooks* 4284; along decommissioned road to Parsnip Lakes on small boulder, *Brooks* 4350.

Pseudoleskea radicata (Mitt.) Macoun & Kindb. (Leskeaceae). Shaded rock, outcrops and tree bases from moderate to high elevations.

Specimens cited: Surveyor Mountain on N-facing boulder field on wall of boulder, *Brooks & Shevock* 3869; along Keno access road near Buck Lake Rd in meadow on volcanic boulder in partial shade, *Shevock & Brooks* 56734; NW of Big Lake Fen on boulder in mixed conifer forest, *Brooks* 4324; 0.8 mi

SW of Old Baldy Mountain and just S of un-named peak in forest on boulder, *Brooks* 4364.

Pseudoleskea saviana (DeNot.) Latzel (Leskeaceae). Base of tree trunks, boulders, outcrops, soil from moderate to high elevations.

Specimens cited: Along ridge immediately above road and upslope of the dam of Howard Prairie Lake, *Shevock & Brooks* 56757; 300 ft E of small pond N of Big Lake in pile of boulders on rock, *Brooks* 4305.

Pseudotaxiphyllum elegans (Brid.) Z.Iwats. (Hypnaceae). On tree trunks or rotting wood from mid to high elevations.

Specimen cited: Downstream of Lost Creek Falls on bark at base of tree in full shade, *Brooks* 4432.

Pterigynandrum filiforme Hedw. (Pterigynandraceae). On bases of trees and on rock at mid to high elevations.

Specimens cited: 500 ft E of Lost Creek Falls on base of Douglas fir in full shade, *Brooks* 4104; 0.5 mi SE of Round Mountain below closed BLM road in forest opening on boulders, *Brooks* 4472; 0.5 mi SE of Lost Lake on rock pile near small subpeak in mixed conifer forest, *Brooks* 4515.

Ptychomitrium gardneri Lesq. (Ptychomitriaceae). On rock in forests at low to mid elevations. Never occurring in great quantities though common, it is easily identifiable when dry by its medium sized, crisped contorted leaves and its often present calyptra, which is lobed roughly half of its length.

Specimens cited: Salt Ridge near Walker Creek in oak savannah on boulder, *Brooks* 3239; Gaerky Creek on dry boulder, *Brooks* 3282; just outside of Buck Rock Tunnel on rock wall, *Brooks* 3495; Baldy Creek Rd 0.5 mi S of Little Pilot Rock on small roadside outcrop, *Brooks* 3641; NW of Big Lake Fen on boulder in mixed conifer forest, *Brooks* 4325; 0.5 mi SE of Lost Lake on rock pile near small subpeak in mixed conifer forest, *Brooks* 4517.

Ptychostomum creberrimum (Taylor) J.R.Spence & H.P.Ramsay (Bryaceae). Damp to dry soil, soil over rock or occasionally wood, from low to high elevations.

Specimens cited: Mariposa Lily Botanical Area in ephemeral drainage in oak savannah on sand, *Brooks* 3398; 1 mi N of Fog Rock on base of black oak, *Brooks* 3513; 0.5 mi W of Pilot Rock in mixed conifer forest on soil, *Brooks* 3538; near Lone Pilot Trail in ephemeral drainage, *Brooks* 3544; just above Dutch Oven Creek on base of incense cedar, *Brooks* 3679; 1.25 mi NE of Soda Mountain along road in seep, *Brooks* 3766; Keno Access Rd and Buck Lake Rd intersection in small rivulet, *Brooks & Shevock* 3850.

Ptychostomum pallescens (Schleich. ex Schwägr.) J.R.Spence (Bryaceae). Damp to wet soil from low to high elevations.

Specimen cited: 300 ft E of small pond N of Big Lake on exposed root on soil and wood, *Brooks* 4312.

Ptychostomum pseudotriquetrum (Hedw.) J.R.Spence & H.P.Ramsay (Bryaceae). Wet soil, soil over rock. Specimens cited: 0.5 mi N of Randcore Pass in rocky meadow, *Brooks* 3355; near Lone Pilot Trail in ephemeral drainage, *Brooks* 3545; 1 mi N of Hyatt Lake in rocky meadow, *Brooks & Shevock* 3842.

Pulviger a howei (Renauld & Cardot) F.Lara, Draper & Garilleti (Orthotrichaceae). On bark of trees at mid elevations, often associated with interior conifer forests. This species is a member of the *Pulviger a lyellii* complex. See discussion under *P. lyellii* for differences between species relating to this group. Specimens cited: On fallen tree branch upslope of Big Lake Fen in mixed conifer forest, *Brooks* 4296; on branches and trunk of large ash along Jenny Creek in flood plain, *Brooks* 4491; along Lost Creek on *Taxus* L., twig suspended over creek, *Brooks* 4538; along Lost Creek on branch of *Cornus sericea* L., *Brooks* 4540; 0.25 mi S of Lost Creek Lake along creek on maple branch, *Brooks* 4543.

Pulviger a lyellii (Hook. & Taylor) Plášek, Sawicki & Ochyra (Orthotrichaceae). On hardwood or conifer bark. [*Orthotrichum lyellii*]. The *P. lyellii* complex was recently split into 4 distinct species by Lara et al. (2020). These include *P. lyellii*, *P. howei*, *P. papillosa*, and *P. pringlei* (Müll.Hal.) F.Lara, Draper & Garilleti all of which occur in Oregon. *P. lyellii* is easily distinguishable in the field from its common counterpart *P. papillosa* by the dense growth of propagules on most leaves which can be seen with a hand lens. *P. papillosa* and *P. howei* tend to differ in that the former occurs at lower elevations, has 16 distinct exostome teeth (rather than remaining joined as in *howei*), and by its plane leaf margins versus recurved in *howei*. *Pulviger a pringlei* is typically much larger than the previously mentioned species with long, slightly flexuose leaves when dry. It is often the dominant species from this group in areas with coastal influence, however it also occurs in the west Cascades.

Specimens cited: On downed tree above Dutch Oven Creek, *Brooks* 2113; on *Alnus* Mill., trunk along Keene Creek, *Brooks* 3113; Salt Ridge above Walker Creek on base of white oak, *Brooks* 3248; 0.5 mi N of Iron Gate Lake on oak, *Brooks* 3282*; Mariposa Lily Botanical Area above seasonal drainage on white oak against large rock outcrop, *Brooks* 3418; along decommissioned road on oak, 0.6 mi N of Buck Rock, *Brooks* 3487.

Pulviger a papillosa (Hampe) F.Lara, Draper & Garilleti (Orthotrichaceae). On bark of trees, primarily oaks in open woodlands. [*Orthotrichum papillosum*]. See description for *P. lyellii* for a brief discussion of the *P. lyellii* complex.

Specimens cited: Horseshoe Ranch Wildlife Area on Oregon white oak, *Brooks* 3158; decommissioned road 0.5 mi W of Buck Rock on oak, *Brooks* 3488; 1

mi WSW of Pilot Rock in mixed juniper/oak on branch of white oak, *Brooks* 3562; Lost Creek Falls on branch of *Acer glabrum* along Lost Creek 100 ft below waterfall, *Brooks* 4116; 450 ft NW of Big Lake Fen on trunk of *Acer* in canopy gap, *Brooks* 4319; top of Lost Creek Falls on alder branch along creek, *Brooks* 4416.

Pulviger a pringlei (Müll. Hal.) F. Lara, Draper & Garilleti (Orthotrichaceae). On bark of hardwood trees at low to mid elevations. This species is a member of the *Pulviger a lyellii* complex. See discussion under *P. lyellii* for differences between species relating to this group.

Specimen cited: Emigrant Creek Falls, 50 ft S of falls on branch of Pacific yew along creek *Brooks* 4647.

Rectithecium piliferum (Sw.) Hedenäs & Huttunen (Plagiotheciaceae). On shaded rocks or in rock crevices from mid to high elevations. [*Plagiothecium piliferum*]. Easily identified in the field by its complanate habit and glossy leaves contracted to a long filiform acumen that resembles an exceptionally long hair point.

Specimen cited: Top of Lost Creek Falls on rock in splash zone, *Brooks* 4412.

Rhytidiadelphus loreus (Hedw.) Warnst. (Hylocomiaceae). On trees or rock in shady situations at moderate elevations.

Specimen cited: 0.25 mi W of Lost Creek Falls on cliff face, *Brooks* 4456.

Rhytidiadelphus triquetrus—See *Hylocomiadelphus triquetrus*

Roellobryon roellii (Broth.) Ochyra (Bryaceae). Litter and humus from mid to high elevations. [*Roellia roellii*].

Specimens cited: 0.5 mi W of Pilot Rock in mixed conifer forest on soil, *Brooks* 3539; near Boccard Point in dry seasonal drainage in mixed conifer forest on litter, *Brooks* 3667; 1.25 mi E of Soda Mountain along road in mixed conifer forest on soil, *Brooks* 3764; 0.25 mi E of Big Lake on steep forested slope in mixed conifer forest on soil, *Brooks* 4287; W of Oregon Gulch along closed road on soil bank, *Brooks & Shevock* 3839.

Rosulabryum canariense (Brid.) Ochyra (Bryaceae). Moist soil banks or soil over rock. Specimens cited: Mariposa Lily Botanical Area in oak savannah on soil at base of oak, *Brooks* 3396; 700 ft S of Buck Rock on closed road, *Brooks* 3491.

Rosulabryum capillare (Hedw.) J.R.Spence (Bryaceae). Moist shaded soil, soil banks and rotting wood from low to high elevations.

Specimens cited: 300 ft E of small pond N of Big Lake at base of *Acer glabrum* on soil, *Brooks* 4308; 0.25 mi W of Lost Creek Falls on cliff face, *Brooks* 4454b.

Rosulabryum elegans (Nees ex Brid.) Ochyra (Bryaceae). Rock, soil in mountainous areas, moderate to

high elevations. This species has been collected only twice before in Oregon though it is reasonably common in neighboring California indicating that it has most likely been overlooked in the past.

Specimens cited: 2 mi NW of Agate Flat along Skookum Creek on dry rock outcrop in recess on soil, *Brooks* 3759; 0.75 mi SW of Joes Rock below road in open rocky meadow on outcrop, *Brooks* 4658.

Rosulabryum erythroloma (Kindb.) J.R.Spence (Bryaceae). Moist shaded soil, soil banks, rock and rotting wood from low to moderate elevations. This species is quite common in the West Cascades, especially along roads. In the Monument, the species was found only once in a very dry habitat with Great Basin influence indicating a great tolerance for a range of environmental conditions.

Specimen cited: Mariposa Lily Botanical Area above seasonal drainage on large rock outcrop, *Brooks* 3419.

Rosulabryum flaccidum (Brid.) J.R. Spence (Bryaceae). Exposed to shaded rock or soil over rock, occasionally rotting wood or bark from low to high elevations. This is the third record of this species from Oregon, with two records occurring in the Monument and the third in the very southern reaches of the Eagle Cap Mountains in northeastern part of the state. This species is probably more common than collections would indicate and is most likely overlooked, under-collected or simply mis-identified.

Specimens cited: 0.5 mi W of Green Springs Mountain and just below ridgeline at base of rock outcrop, *Brooks* 4625; Ridge above Shale City Road, 1.5 mi NE of junction with Dead Indian Memorial Road and 10 mi NE of Ashland, *Wagner m0335* (OSC).

Rosulabryum gemmascens (Kindb.) J.R.Spence (Bryaceae). Exposed to shaded soil, soil over rock, rock or rotting wood from low to high elevations. This is a small, cryptic species that is often easy to overlook and its resemblance to the common *R. capillare* is most likely the culprit. Though little reported in Oregon, this species is widely reported from neighboring California from many differing elevations and substrates ranging from bark to stone and from near sea level to tree line. Within the Monument this species was found many times, suggesting this species is most likely under-collected and through increased survey efforts many more locations for this species are likely to be discovered. Specimens cited: Vicinity of Keene Creek in dry meadow on boulder, *Brooks* 3125; boulder along Camp Creek, *Brooks* 3181; Mariposa Lily Botanical Area above seasonal drainage at base of juniper on soil, *Brooks* 3423; 0.75 mi SE of Howard Prairie Lake above Soda Creek in recess of outcrop on soil over rock, *Brooks & Shevock* 3890.

Rosulabryum torquescens (Bruch ex Schimp.) J.R.Spence (Bryaceae). Soil, rock, rotting wood from

low to moderate elevations. The only previous record for this species in Oregon is along the Columbia River west of Hood River, *Carter* 2579 (SJSU).

Specimen cited: 0.5 mi W of Pilot Rock along Pilot Rock Trail on soil, *Brooks* 3537.

Schistidium cinclidodonteum (Müll.Hal.) B.Bremer (Grimmiaceae). Wet or dry rock, typically along intermittent watercourses, or dry outcrops nearer the coast, from low to moderate elevations. This semi-rheophytic species is rare in Oregon with most known locations confined to the southern part of the state. The prominent apiculus at the terminal end of the leaf often makes this species distinguishable in the field.

Specimens cited: Just above Dutch Oven Creek W of Boccard Point in open rocky meadow surrounded by mixed conifer forest in full sun, *Brooks* 3669; Oregon Gulch along intermittent streamlet on volcanic boulder, *Shevock & Brooks* 56709; on boulder along Jenny Creek, *Brooks* 4487.

Schistidium confertum (Funck) Bruch & Schimp. (Grimmiaceae). On rock in shaded habitats from mid to high elevations.

Specimens cited: E ridge above Jenny Creek on small boulder, *Brooks* 3294*; Oregon Gulch on rock near intermittent stream, *Brooks* 3834; 0.25 mi S of Buck Prairie Rd along un-named dirt road in meadow on boulder, *Brooks & Shevock* 3920; 0.25 mi NW of Big Lake and just W of Quarter Corner Bog on large boulder in bog, *Brooks* 4334.

Schistidium dupretii (Thér.) W.A.Weber (Grimmiaceae). Exposed to semi-shaded rock, moderate to high elevations.

Specimens cited: 0.5 mi W of Pilot Rock along trail on gravel, *Brooks* 3534; Baldy Creek Rd 0.5 mi S of Little Pilot Rock on small roadside outcrop, *Brooks* 3649; 0.75 mi E of Soda Mountain near Skookum Creek Rd on boulder, *Brooks* 3728; Keno Access Rd and Buck Lake Rd intersection on dry rock, *Brooks & Shevock* 3867.

Schistidium flaccidum (DeNot.) Ochyra (Grimmiaceae). On rock in open to shaded habitats from mid to high elevations. This is the second record in Oregon for this cryptic species, the first having been collected by Dan Norris (109372 UC) at the Opal Creek Ancient Forest Center in the Willamette National Forest on a roadside outcrop.

Specimen cited: Baldy Creek Rd 0.5 mi S of Little Pilot Rock on small roadside outcrop, *Brooks* 3640.

Schistidium heterophyllum (Kindb.) T.T.McIntosh (Grimmiaceae). Rock at moderate elevations. This species is much more common east of the Cascade divide. The single collection from the Monument represents only the third reported specimen in Oregon and the southernmost within the Pacific Coast states.

Specimen cited: 0.75 mi SW of Joes Rock below BLM road in open meadow/rock outcrop complex in small 'cave' within outcrop, *Brooks* 4664.

Schistidium rivulare (Brid.) Podp. (Grimmiaceae). A rheophytic species found on rocks in streams, often in shaded habitats from low to high elevations.

Specimens cited: Bank of Keene Creek on rock, *Brooks 3112*; on boulder along Camp Creek, *Brooks 3176*; Keno Access Rd and Buck Lake Rd intersection in small rivulet, *Brooks & Shevock 3849*; 650 ft E of Lost Creek Falls on small boulder in stream channel, *Brooks 4397*.

Schistidium splendens T.T.McIntosh, H.H.Blom, D.R.Toren & Shevock (Grimmiaceae). Loose glossy tufts on boulders along streams and seasonal drainages or on dry rock. This species described by McIntosh et al. (2015) is the most encountered *Schistidium* Bruch & Schimp. in the Monument. Specimens cited: E branch of Cottonwood Creek, *Brooks 2110*; Dutch Oven Creek on rock, *Brooks 2115*; on boulder along Keene Creek, *Brooks 3107*; Cathedral Cliffs on outcrop, *Brooks 3168*; Walker Creek on boulder at high water mark, *Brooks 3254*; 0.25 mi S of Pilot Rock near small peak on small outcrop, *Brooks 3324*; 0.5 mi N. of Randcore Pass in oak/juniper woodland on boulder, *Brooks 3345*; 0.5 mi N of Randcore Pass in rocky meadow, *Brooks 3352*; Mariposa Lily Botanical Area in ephemeral drainage on small boulder, *Brooks 3401*; decommissioned road 0.6 mi N of Buck Rock, *Brooks 3486*; just outside of Buck Rock Tunnel on rock wall, *Brooks 3494*; 1 mi WSW of Pilot Rock in mixed juniper/oak in dry ephemeral drainage on rock, *Brooks 3566*.

Schistidium squarrosus T.T.McIntosh, H.H.Blom, D.R.Toren & Shevock (Grimmiaceae). Rock outcrops with minimal runoff and boulders along streams and seasonal drainages. Like *S. splendens* this species was also recently described (McIntosh et al. 2015), though not as common as the former. This species is also semi-rheophytic and is most closely related to *Schistidium cinclidodonteum* and a reliable field character to separate these two is that later has a leaf ending in a terete apiculus.

Specimens cited: Rock in dry meadow vicinity of Keene Creek, *Brooks 3129*; in recess of outcrop on Cathedral Cliffs, *Brooks 3169*; 0.25 mi S of Pilot Rock near small peak on small outcrop, *Brooks 3314*; 0.5 mi N of Randcore Pass in oak/juniper woodland on boulder, *Brooks 3353*; 0.75 mi N of Soda Mountain along road in meadow on large boulder, *Brooks 3771*; on small W-facing dry outcrop within mixed conifer forest just E of Jenny Creek, *Brooks 4484*; on S-facing rock slab on grassy slope above Lost Creek canyon, *Brooks 4523*.

Schistidium strictum (Turner) Loeske ex Mårtensson (Grimmiaceae). Rock in open to shaded habitats from low to high elevations.

Specimen cited: 300 ft E of small pond N of Big Lake in mixed conifer forest on boulder, *Brooks 4304*.

Sciuro-hypnum hylotapetum (B.L.Higinb. & N.L.Higinb.) Ignatov & Huttunen (Brachytheciaceae). On

litter or duff in conifer forest at moderate elevations. Though collected many times in northern Oregon, east of the divide, this is the first record for this species in southern Oregon and the southernmost record along the west coast.

Specimen cited: 650 ft downstream of Lost Creek Falls on forest floor along creek in mixed conifer woodland, *Brooks 4451*.

Scleropodium cespitans (Müll.Hal.) L.F.Koch (Brachytheciaceae). Shaded rock, soil, and tree bases.

Specimen cited: On rock on bank of Camp Creek, *Brooks 3180*.

Scleropodium obtusifolium (Mitt.) Kindb. (Brachytheciaceae). Semiaquatic on rock or wood. Our most common rheophyte within the Monument, it is found growing on rocks in most ephemeral and perennial drainages. The habit of this plant, when dry, is of golden worm-like shoots laying on rocks within the stream channel.

Specimens cited: E branch of Cottonwood Creek, *Brooks 2109*; on boulder along Cottonwood Creek, *Brooks 3153**; on boulder on the side of Keene Creek, *Brooks 3108*; just above Keene Creek in Ponderosa pine woodland, *Brooks 3123*; Jenny Creek on boulder, *Brooks 3206**; Walker Creek on boulder in splash zone, *Brooks 3251*; Horseshoe Wildlife Area along Scotch Creek 0.5 mi past gate on rock overhang above pour over, *Brooks 3381*; 1 mi N of Fog Rock on base of black oak, *Brooks 3517*; near Bocard Point in dry seasonal drainage in mixed conifer forest, *Brooks 3665*; on boulder in splash zone of Dutch Oven Creek, *Brooks 3675*; Horseshoe Wildlife Area at road crossing of Scotch Creek W of old farmstead, *Brooks 4549*.

Scleropodium occidentale B.E.Carter (Brachytheciaceae). Subaquatic habitats from low to high elevation. This species is similar to *S. obtusifolium* and is slightly more common than the latter in ephemeral drainages in exposed oak woodlands (Carter 2012). It can be differentiated microscopically by its spine tipped costa which is often longer than that of *obtusifolium*. Specimens cited: Gaerky Creek on boulder in creek *Brooks 3284*; on boulder in Keene Creek, *Brooks 3109*; 1 mi WSW of Pilot Rock in mixed juniper/oak in dry ephemeral drainage on rock, *Brooks 3559*; Oregon Gulch in small stream channel, *Brooks & Shevock 3830*; 0.5 mi SE of Round Mountain below closed BLM road in "right fork" drainage on boulder, *Brooks 4479*.

Scleropodium touretii (Brid.) L.F.Koch (Brachytheciaceae). On soil, hummus, or litter in forested areas at low to moderate elevations.

Specimen cited: Rogue River National Forest, Camp Latgawa, along the Dead Indian Soda Springs trail just behind the camp, *Harpel 17167** (UBC).

Scouleria aquatica Hook. (Scouleriaceae). Aquatic habitats, streams, and rivers on rock from low to high elevations. This species is common along Lost

Creek, however, it was not noted anywhere else during the field work for this manuscript.

Specimen cited: Lost Creek Falls on rock slab at base of waterfall in shade, *Brooks 4111*.

Sphagnum fuscum (Schimp.) H.Klinggr. (Sphagnaceae). Bogs, hummocks, fens. This is the only population of *Sphagnum* in the Monument and is within The Nature Conservancy's Sharon Fen Preserve.

Specimen cited: 0.5 mi NW of Big Lake in Quarter Corner Bog on hummock, *Brooks 4338*.

Stereodon subimponens (Lesq.) Broth. (Stereodontaceae). Epiphytic on trees, cliffs, outcrops, and decaying logs at low to moderate elevations [*Hypnum subimponens*].

Specimens cited: On trunk of *Alnus* along Keene Creek, *Brooks 3114*; decommissioned road 0.6 mi N of Buck Rock, *Brooks 3485*; top of Lost Creek Falls on rotten log in splash zone, *Brooks 4414*; S end of Lost Lake on N-facing boulder, *Brooks 4550*.

Syntrichia laevipila Brid. (Pottiaceae). Bark of hardwood trees. Though almost exclusively found on hardwoods in our area, specimens 3220 and 3308 were found on rock, a very unusual substrate for this species.

Specimens cited: On rock outcrop along Jenny Creek, *Brooks 3220**; Salt Ridge along Dead Indian Memorial Hwy on oak bark, *Brooks 3233*; on ridge E of Jenny Creek on white oak, *Brooks 3289**, and in rock crevice on cliff, *Brooks 3308**; Mariposa Lily Botanical Area on large white oak in oak savannah, *Brooks 3424*; Scotch Creek just past old cabin on white oak, *Brooks 3442*.

Syntrichia latifolia (Bruch ex Hartm.) Huebener (Pottiaceae). Bark of trees from low to high elevations.

Specimens cited: On branch of large ash tree along Jenny Creek, *Brooks 4490*; S end of Lost Lake on trunk of *Salix*, *Brooks 4544*.

Syntrichia montana Nees (Pottiaceae). On sunny rock or thin soil over rock. This species has few reported occurrences in Oregon, though within the Monument it is quite common in areas with at least some Great Basin influence.

Specimens cited: Just S of Cathedral Cliffs on rocky summit, *Brooks 3160*; 0.25 mi W of Gaerky Creek in Ashland on boulder, *Brooks 3274*; Horseshoe Wildlife Area along Scotch Creek on rock outcrop, *Brooks 3383*; Scotch Creek just before old cabin on dry outcrop, *Brooks 3444*; 0.5 mi W of Pilot Rock along trail just above small swale on gravel, *Brooks 3536*; 2 mi NW of Agate Flat along Skookum Creek on dry rock, *Brooks 3752b*; 0.5 mi NW of Big Lake and just W of Quarter Corner Bog on large boulder in bog, *Brooks 4330*.

Syntrichia norvegica F.Weber (Pottiaceae). Soil, rock at high elevations. This species can sometimes be

identified in the field by its rust colored to reddish awn.

Specimen cited: Along the summit ridge of Surveyor Mountain, *Shevock & Brooks 56742*.

Syntrichia papillosissima (Copp.) Loeske (Pottiaceae). On exposed soil at low elevations.

Specimen cited: Mariposa Lily Botanical Area in oak savannah on soil at base of oak, *Brooks 3397*.

Syntrichia princeps (DeNot.) Mitt. (Pottiaceae). On rock or soil over rock or tree trunks. Specimens cited: Above Keene Creek in forest on boulder, *Brooks 3132*; Salt Ridge along Dead Indian Memorial Hwy on oak bark, *Brooks 3234*; 0.25 mi S of Pilot Rock near small peak on small outcrop, *Brooks 3322*; Mariposa Lily Botanical Area in oak savannah on soil at base of oak, *Brooks 3395*; just above Brushy Creek/Scotch Creek confluence on boulder, *Brooks 3433*; near Boccard Point in dry seasonal drainage in mixed conifer forest, *Brooks 3666*; Keno Access Rd and Buck Lake Rd intersection on dry rock, *Brooks & Shevock 3860*.

Syntrichia ruralis (Hedw.) F.Weber & D.Mohr (Pottiaceae). Dry to moist soil or rock, low to high elevations.

Specimens cited: 0.25 mi S of Pilot Rock in open talus on rock, *Brooks 3334*; 0.5 mi N. of Randcore Pass on old roadbed, *Brooks 3344*; Horseshoe Wildlife Area along Scotch Creek on rock outcrop, *Brooks 3382*; 1 mi N of Fog Rock on base of black oak, *Brooks 3516*; 1 mi WSW of Pilot Rock on soil, *Brooks 3569*; Baldy Creek Rd 0.5 mi S of Little Pilot Rock on small roadside outcrop, *Brooks 3636*; 0.75 mi N of Soda Mountain along road in meadow on large boulder, *Brooks 3769*; along 40-4e-4 road S of Pinehurst Inn, *Brooks 4495*; along Hwy 99 on W-facing outcrop near state line, *Brooks 4505*.

Syntrichia virescens (DeNot.) Ochyra (Pottiaceae). Dry rock at higher elevations. A segregate of *S. ruralis*, this species can be separated by its relatively smaller size and leaves that are constricted near middle.

Specimen cited: 1 mi SW of Old Baldy Mountain along BLM road on outcrop, *Brooks 4363*.

Syntrichia sp. (Pottiaceae). Dry to moist soil or rock, low to high elevations. This is an undescribed species awaiting formal description. It is common in both California and Oregon in oak woodland and coniferous forests and occupies similar habitats as those of *S. ruralis* and *S. princeps* (Jim Shevock, CAS, personal communication).

Specimens cited: Salt Ridge near Dead Indian Memorial Hwy on boulder, *Brooks 3232*; 0.25 mi S of Pilot Rock near small peak on small outcrop, *Brooks 3323* and *Brooks 3327*; Mariposa Lily Botanical Area 0.7 mi E of Chocolate Falls along seasonal creek on outcrop, *Brooks 3412*; 2 mi NW of Agate Flat along Skookum Creek on dry rock, *Brooks 3757*; Surveyor Mountain in N-facing boul-

der field in deep recess, *Brooks & Shevock* 3881; 0.8 mi SW of Old Baldy Mountain and just S of unnamed peak in forest on boulder, *Brooks* 4367.

Timmia austriaca Hedw. (Timmiaceae). Shaded cliffs at moderate elevations.

Specimen cited: 0.25 mi W of Lost Creek Falls on S-facing cliff face, *Brooks* 4455.

Timmiella crassinervis (Hampe) L.F. Koch (Pottiaceae). On soil on trail or roadsides from low to moderate elevations.

Specimen cited: Camp Latgawa along Dead Indian Soda Springs Trail just behind camp on trail in full sun *Harpel* 17172* (UBC).

Tomentypnum nitens (Hedw.) Loeske (Brachytheciaceae). Open fens at high elevations on the east side of the High Cascades. In North America, this species has its center of distribution in Canada and Alaska. In the United States, this moss is common in fen communities throughout the interior west and its range extends into the High Cascades, however, is unknown in the West Cascades and Coast Ranges. It is rare from neighboring California in the Lake Tahoe region.

Specimen cited: On wet peat at SW edge of Buck Lake at Tunnel Creek wetlands on soil, *Dewey* 061314-1546.

Tortula subulata Hedw. (Pottiaceae). Soil, occasionally rock, at low to moderate elevations. Specimen cited: Along Baldy Creek Rd 0.5 mi S of Little Pilot Rock on small roadside outcrop, *Brooks* 3651.

Trachybryum megaptilum (Sull.) W.B.Schof. (Brachytheciaceae). On litter and hummus, occasionally rock, in coniferous forests at low to mid elevations. Specimens cited: Decommissioned road 0.6 mi N of Buck Rock, *Brooks* 3484; 1000 ft NW of Lost Creek Falls on soil on S-facing cliff face, *Brooks* 4453b; 0.5 mi SE of Round Mountain below closed BLM road in forest on litter in mixed conifer forest, *Brooks* 4477; 1000 ft W of Lost Creek Falls on litter in conifer forest, *Brooks* 4510.

Tripterocladium leucocladulum (Müll.Hal.) A.Jaeger (Lembophyllaceae). Dry shaded cliffs and boulders at moderate elevations.

Specimens cited: Lost Creek Falls on rock slab at base of waterfall in shade, *Brooks* 4114; 1000 ft NE of Emigrant Creek Falls in recess of large boulder *Brooks* 4657.

Trochophyllohypnum circinale (Hook.) Jan Kučera & Ignatov. (Pylaisiadelphaceae). From mid to high elevations on trees, rotting wood or rock. [*Hypnum circinale*].

Specimen cited: Downstream of Lost Creek Falls on rotten log along creek, *Brooks* 4445.

Weissia controversa Hedw. (Pottiaceae). Soil or rock in natural and disturbed areas at low to moderate elevations.

Specimens cited: Horseshoe Wildlife Area just above Scotch Creek on dry rock outcrop in recess, *Brooks* 3389; 2 mi NW of Agate Flat along Skookum Creek on dry rock outcrop, *Brooks* 3738; in grassy area under small boulder above Lost Creek canyon, *Brooks* 4530.

Weissia ligulifolia (E.B.Bartram) Grout (Pottiaceae). Dry soil or rocks in crevices or shaded areas from moderate to high elevations. Relatively common in the southwestern United States this specimen represents the first report for Oregon.

Specimen cited: On S-facing rock outcrop in recess above Lost Creek canyon, *Brooks* 4529.

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BRYOFLORA OF THE SHOSHONE NATIONAL FOREST, WYOMING. PART 1.
A CATALOGUE OF MOSSES AND LIVERWORTS OF THE BEARTOOTH PLATEAU AREA

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ABSTRACT

This work is the first in a series of catalogues on the bryophytes of the oldest National Forest of the USA, the Shoshone National Forest. Bordering Yellowstone National Park and being a part of the Greater Yellowstone System, the Forest has retained a wide spectrum of its pristine representative areas, which support a unique bryophyte flora. Based on over 4600 specimens, the catalogue of the bryophytes of the Wyoming's Beartooth Plateau, the northernmost territories of the Forest, has been produced. This bryoflora is composed of 282 species (45 liverworts and 237 mosses) in the study area, representing approximately 53% of the Wyoming bryophyte flora. The richness of the flora is due to the high diversity of habitats, caused by the geological history of this portion of the Central Rocky Mountains, location of the study area essentially in the subalpine and alpine belts, climatic and hydrologic features, and low anthropogenic disturbance. The high elevations and associated habitat conditions allow for many disjunct arctic-alpine species (approximately 25% in the bryophyte flora). Remarkable extensions of upper elevation limits for 72 taxa are registered. Fifteen species, two subspecies, and two varieties of liverworts, as well as 56 species and eight varieties of mosses have not previously been reported for Wyoming in Flora of North America and Synopsis of Liverwort Flora of North America North of Mexico. Thirty-nine taxa (five species of liverworts and 32 species and two varieties of mosses) are of potential conservation concern in Wyoming, including two rare species with Pacific coastal affinities, *Philonotis yezoana* Besch. & Cardot and *Sphagnum miyabeaenum* Warnst., and one species of extreme northern habitats, *Sciuro-hypnum glaciale* (Schimp.) Ignatov & Huttunen, being a novelty for continental North America. *Brachythecium erythrorrhizon* Schimp. var. *alpinum* Kosovich-Anderson & Ignatov was recently described, using material collected as part of this study.

Key Words: Beartooth Plateau, bryophytes, Central Rocky Mountains, Shoshone National Forest, Wyoming.

Wyoming being a world-renowned land of national parks and natural monuments, which attracts researchers from all across the world, has undergone multi-disciplinary studies for decades. However, until recently, this state has been a bryological frontier – many of its territories, including environmentally protected ones, have remained “blank gaps” bryologically. So far, bryophyte distribution and conservation status have not been determined for either of the National Park Service or U.S. Forest Service units in the state.

The Shoshone National Forest (SNF) is the oldest federally protected National Forest in the United States. It was created by an act of Congress and signed into law by U.S. President Benjamin Harrison in 1891. The Forest covers part of three major mountain ranges in the Central Rocky Mountains of northwestern Wyoming; these include, in order of diminishing areal extent – Absaroka, Wind River, and Beartooth Mtns., all three are geologically distinct from each other. Elevation ranges from 1400 m (4600 ft) near Cody to 4207 m (13,800 ft) at the top of Gannett Peak. The Forest occupies a vast landscape of nearly 9983.23 km² (2,466,909 acres); it lies within five counties of the state: Fremont, Hot Springs, Park, Sublette, and Teton. Bordering Yellowstone National Park and being a part of the Greater Yellowstone System, the SNF has never been heavily exploited, and has retained a wide

spectrum of its pristine representative areas. Fifty-six percent of the Forest area is designated wilderness. With its picturesque and largely undeveloped natural landscapes, from sagebrush plains through dense fir and spruce forests, willow- and moss-lined streams, glacial lakes, alpine tundra and fens, to steep mountain slopes and peaks, the Forest is extremely rich in biodiversity. Since 1970's, the SNF has been actively studied botanically, however, a bryophyte inventory has never been performed.

A systematic survey of the bryoflora in the SNF was initiated by the U.S. Forest Service (USFS), Rocky Mountain Region (R2), in 2008, as one of the few bryophyte inventories ever conducted in the U.S. Rocky Mountains. As a Wyoming resident bryologist, I was invited to do research toward developing a bryoflora of the first National Forest of the United States. The study was conducted on subsequent contracts with the USFS and the Wyoming Natural Diversity Database (WYNDD) from 2008–2016. Distribution and documentation of the bryophytes (mosses and liverworts) of the SNF has been the subject of this project.

The present work is based on the results of my expeditions to the mountains of the Wyoming's Beartooth Plateau, the northernmost territories of the SNF (Fig. 1). Much of the preliminary information is derived from an earlier technical report (Kosovich-Anderson 2011a), which was updated

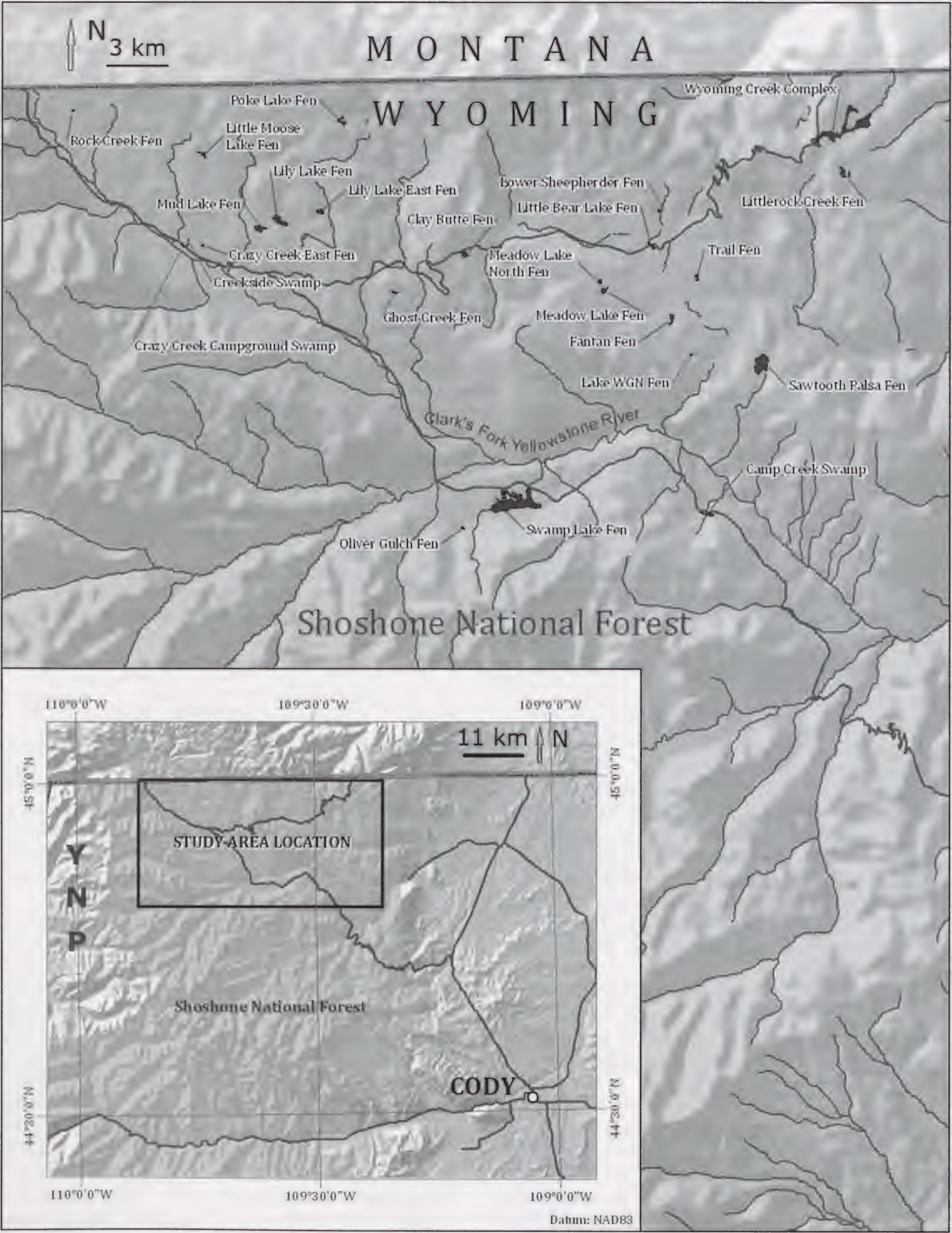


FIG. 1. Map of the study area. The Shoshone National Forest, with its northernmost Beartooth Plateau area, borders Yellowstone National Park (YNP) and is part of the Greater Yellowstone System.

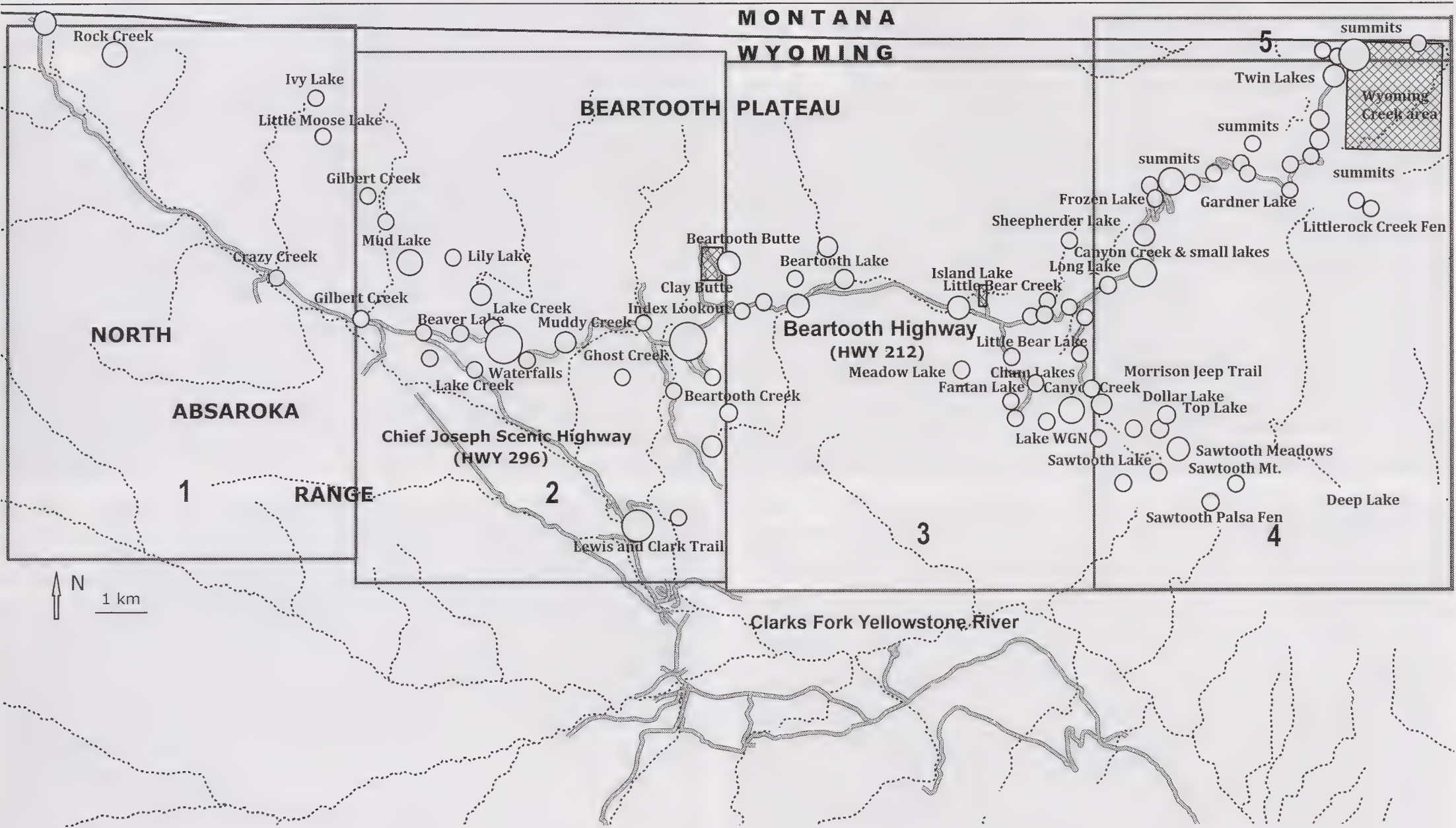


FIG. 2. Bryophyte collecting localities. Quadrangles: 1 – Jim Smith Peak, 2 – Muddy Creek, 3 – Beartooth Butte, 4 – Deep Lake, 5 – Black Pyramid Mountain. Geographic names included for reference in association with collections in catalogue. Two and more collecting sites located in close proximity to each other are marked with a bigger circle.

over the course of additional field and laboratory research. This publication is the first work in a series of catalogues on the bryophytes of the SNF.

STUDY AREA: A BRIEF PHYSIOGEOGRAPHIC OVERVIEW

The Beartooth Plateau (hereafter referred to as the study area) is a part of the Beartooth-Absaroka mountain complex in the Central Rocky Mountains, located in south central Montana and northwest Wyoming, immediately northeast of Yellowstone National Park. The total size of the Plateau is about 130 km long and about 64 km wide. The Wyoming portion represents the small southern end of the whole formation, which comprises less than 20% of the mountain range. The contiguous valley of the Clarks Fork of Yellowstone River (Missouri River Basin) is the natural boundary between the Beartooth Plateau and the North Absaroka Range. The Plateau is drained by multiple south-trending tributaries of the Clarks Fork (e.g., Crazy Creek, Lake Creek, Gilbert Creek and others).

The bryophyte inventory embraced the territory of the Plateau of approximately 700 km², within 44°52'00"–45°01'00"N and 109°23'00"–109°50'30"W and elevations ranging from about 2000 to 3400 m (6550–11,150 ft). The general study area falls almost entirely within five USGS topographic quadrangle maps (7.5') as shown in Fig. 2 – Jim Smith Peak, Muddy Creek, Beartooth Butte, Deep Lake, and Black Pyramid Mountain Quadrangles. The area is

managed as part of the Clarks Fork Ranger District, SNF.

The U.S. Highway 212 (Beartooth Highway/Beartooth Pass) and the western portion of the State Highway 296 (Chief Josef Scenic Highway) transverse the Plateau, providing access to USFS roads and trails making a variety of sites readily accessible. Much of the wilderness remains trailless.

Climate

Located in the Central Rocky Mtns., east of the Continental Divide, the Beartooth Plateau experiences a cold, dry, continental climate regime; summers are warm, but dry and short, winters are cold and moist (Bryson and Hare 1974). Annual precipitation ranges from 25 to 157 cm, with increasingly dry conditions toward the eastern side of the Plateau and a strong elevation gradient. Most of the annual precipitation falls as snow. In montane environments, aspect and the direction of the prevailing winds play a role in the movement and deposition of the winter snow pack (Johnson and Billings 1962). Prevailing winds are from the southwest, west, and northwest throughout the year. Windward slopes in the alpine and upper subalpine are commonly swept clear of snow, while snow banks on leeward slopes and depressions may persist until August. Leeward areas have higher available water throughout the growing season. South-facing slopes receive higher levels of radiation and melt-off earlier than more sheltered northerly slopes. The number of frost-free days between 1986 and 1998, using the data from the weather station at

the Beartooth Lake Campground, ranged from 41 to 89 d; frost may occur any month of the year (Mellmann-Brown 2004). There is extensive alpine habitat with low temperatures during the short growing season, with similarities relative to arctic latitudes (Billings 1973). Cold snow-melt water that seasonally fills the streams and elevates groundwater table affects the microclimate of habitats, moderating summer temperatures and supporting humidity in plant communities.

Geology

Beartooth Plateau represents a northwest-trending uplifted fault block of Precambrian granite and crystalline metamorphic rocks, which was partially blanketed with lava from Yellowstone's volcanoes and eroded by glaciers (Lageson and Spearing 1991). The core of the Beartooth Plateau is composed predominantly of granitic gneiss and schist, which are well exposed.

Three stages of Pleistocene glaciation have been provisionally recognized in the Beartooth Plateau. Recent glacial episode – the Pinedale Glaciation – probably remained at full glaciation until 15,000–20,000 yr ago. Streamlined hills with gentle, abraded up-ice slopes and steep, plucked down-ice faces are characteristic of glaciation and common on the Beartooths. Quarternary morainal deposits are dominated by granitic materials that originated at higher elevations.

An extensive, gentle surface, partially dissected by canyons and glacial cirques, occupies most of the Plateau, a substantial part of which is above 3000 m. Numerous alpine and subalpine lakes, high peaks, persistent snowfields, moist north-facing slopes, waterfalls and cascades, riparian corridors are the major features of the area (Figs. 3A–D, 4A–D). The Beartooths contain a broad area of alpine habitats that include boulder fields, talus slopes, moist and dry meadows and tundra, snowbeds, patterned ground, and bedrock outcrops (Eversman 1995). Alternating freezing and thawing of moist soils over long periods (the process of cryoturbation) leads to the formation of characteristic stone polygons and frost boils in the alpine landscape (Knight et al. 2014). On slopes in alpine tundra, solifluction lobes or terraces develop over fellfields. Ancient granite is overlain in places by Cambrian-Devonian carbonates and shales forming limestone cliffs like Clay Butte and Beartooth Butte (Carson et al. 1998, Fig. 3E). Similar formations also occur on the eastern flank of the Beartooth uplift. Base-rich rock at high altitudes supports distinctive flora.

Plant Communities

The range of altitudes within the study area comprises four life zones: the foothills at 2000–2100 m (6550–6900 ft), roughly estimated, through the montane, 2100–2600 m (6900–8550 ft), and subal-

pine, 2600–3000 m (8550–9850 ft), up to the alpine tundra – 3000 m (9850 ft) and above. On the scale accepted in *Flora of North America North of Mexico* (Flora of North America Editorial Committee 2007, 2014), the altitudinal range corresponds to “high elevations” zone (1600 m and more).

The Beartooths are largely above the timberline, and cryophyte-dominated tundra and alpine meadows are the characteristic vegetation (Figs. 3C, D). The growing season at high elevations is as brief as about 45 d. Of the primary alpine vegetation types, Johnson and Billings (1962) describe Alpine Avens (*Geum rossii* (R.Br.) Ser.) turfs on summits, ridges and upper slopes, Tufted Hairgrass (*Deschampsia cespitosa* (L.) P.Beauv.) meadows on lower mesic slopes and basins, Mountain Sedge (*Carex scopulorum* Holm) fens on wet, mineral bog and peat soils, and Diamondleaf Willow (*Salix planifolia* Pursh) thickets along drainages and in the lakesides. The Beartooth Plateau is one of the largest contiguous areas of alpine grassland on the SNF; the Idaho Fescue (*Festuca idahoensis* Elmer)/Spike Trisetum (*Trisetum spicatum* (L.) K.Richt.) community type prevails. The dwarf willows, Rocky Mountain Willow (*Salix petrophila* Rydb.) and Snow Willow (*Salix reticulata* L. var. *nana* Andersson), occur in rocky alpine tundra, alpine and subalpine meadows, and fellfields. Lichen diversity has been studied by Eversman (1995); in alpine meadows, species of the genera *Cetraria* Ach., *Evernia* Ach., and *Vulpicida* Mattsson & M.J.Lai are the most common.

At the highest elevations, alpine soils on Precambrian formations are weakly developed and are loamy and sandy textured. The plants and the soil are sensitive to trampling in this area, especially in the harsh conditions of wind-swept summits. Disturbance of the habitats can also be caused by animal activity (Pocket Gophers, Ground Squirrels, and others) and natural events (like fires, annual flood scouring of stream banks, etc.). Natural springs can be heavily used by wildlife at all elevations. On most visits, we noted wildlife tracks, footprints, trails, bear and deer bedding adjacent to seeps and springs. Anthropogenic impact on the Beartooth Plateau can be estimated as low; it includes few roads, ditches, very limited grazing, and some noxious weeds (Heidel et al. 2017; Kosovich-Anderson unpublished data). The generally low level of disturbance allows many rare and relic species to survive here.

Lower elevations have grass and sagebrush-dominated communities, while forested areas are dominated by combinations of species: Lodgepole Pine (*Pinus contorta* Douglas ex Loudon var. *latifolia* Engelm.), Douglas Fir (*Pseudotsuga menziesii* (Mirb.) Franco var. *glauca* (Mayr) Franco), and Trembling Aspen (*Populus tremuloides* Michx.), found at elevations up to 2800 m; at higher elevations Subalpine Fir (*Abies lasiocarpa* (Hook.) Nutt.) and Engelmann Spruce (*Picea engelmannii* Engelm.), frequently hybridizing in this region with White Spruce (*P. glauca* (Moench) Voss), are common, each

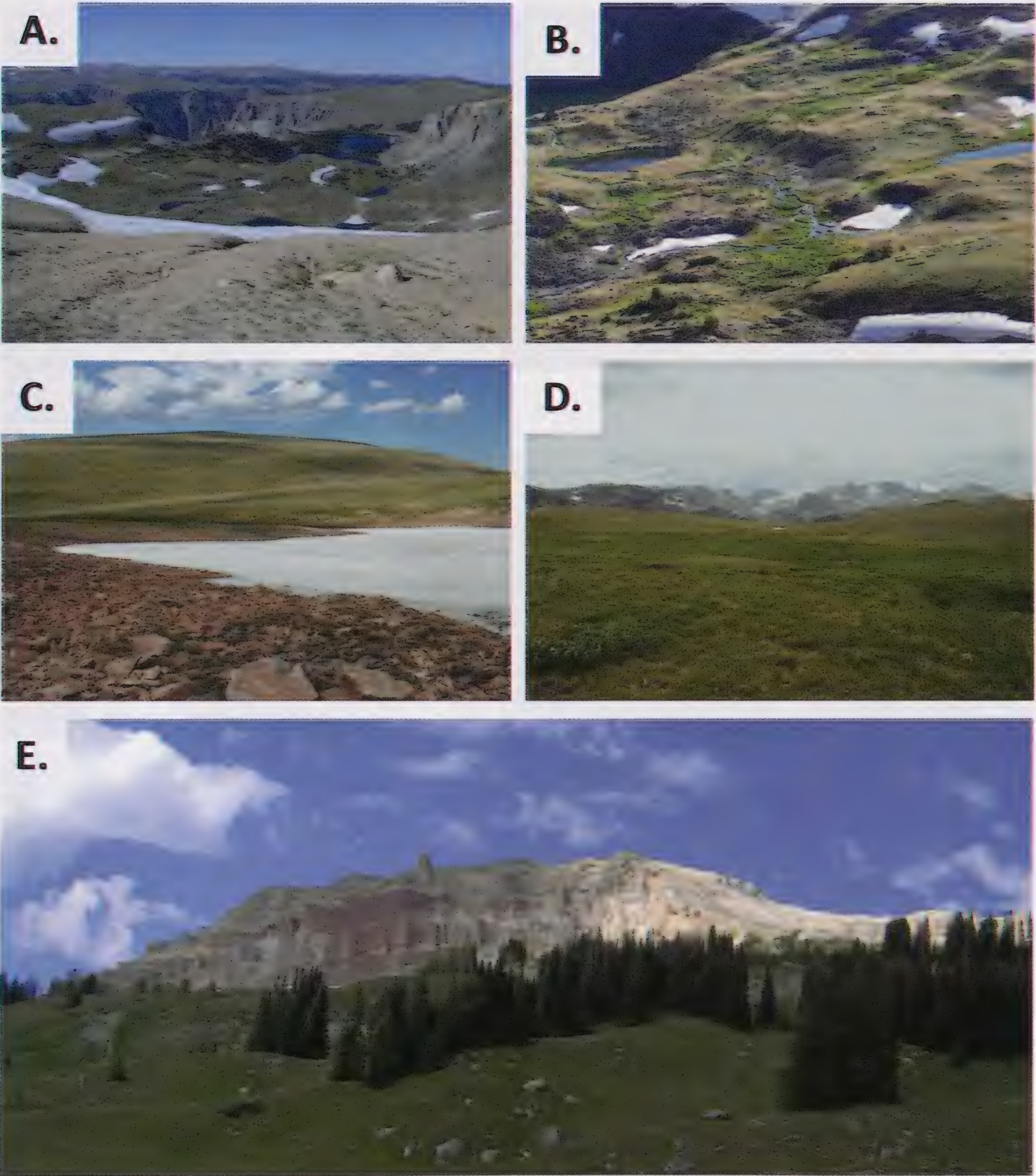


FIG. 3. Beartooth Plateau, Wyoming: typical landscapes. A, B. Glacial landscapes: view of the Plateau from Beartooth Highway (Hwy 212), elev. 2900–3300 m. C. Zone of persistent snowfields at the base of talus slope, elev. 3350 m. Jul. 28, 2010. D. *Geum rossii* (+ *Salix* spp.) –dominated moist alpine tundra, elev. 3300 m. Jul. 28, 2010. E. Limestone cliffs of Beartooth Butte, view from the northern shore of Beartooth Lake, elev. 2750–2900 m. Aug. 23, 2009.

occurring up to the timberline (Fig. 4A). Shady coniferous woods with scattered rock outcrops and decaying fallen trees under their dense canopy are usually crossed by creeks, streams and cataracts fed by snow banks. This habitat type offers a variety of ecotopes to bryophytes and furnishes sufficient moisture for an abundant and taxonomically diverse bryophyte flora (Fig. 4B). Granitic ridges between

subalpine lakes are often occupied by pine forests (Fig. 4C).
Mountain Big Sagebrush (*Artemisia tridentata* Nutt. var. *vaseyana* (Rydb.) B.Boivin) is widespread on the moderately rolling topography and till soils of the glaciated granites from the foothills through the subalpine zone. On the same elevations in mesic conditions of creek valleys, Shrubby Cinquefoil

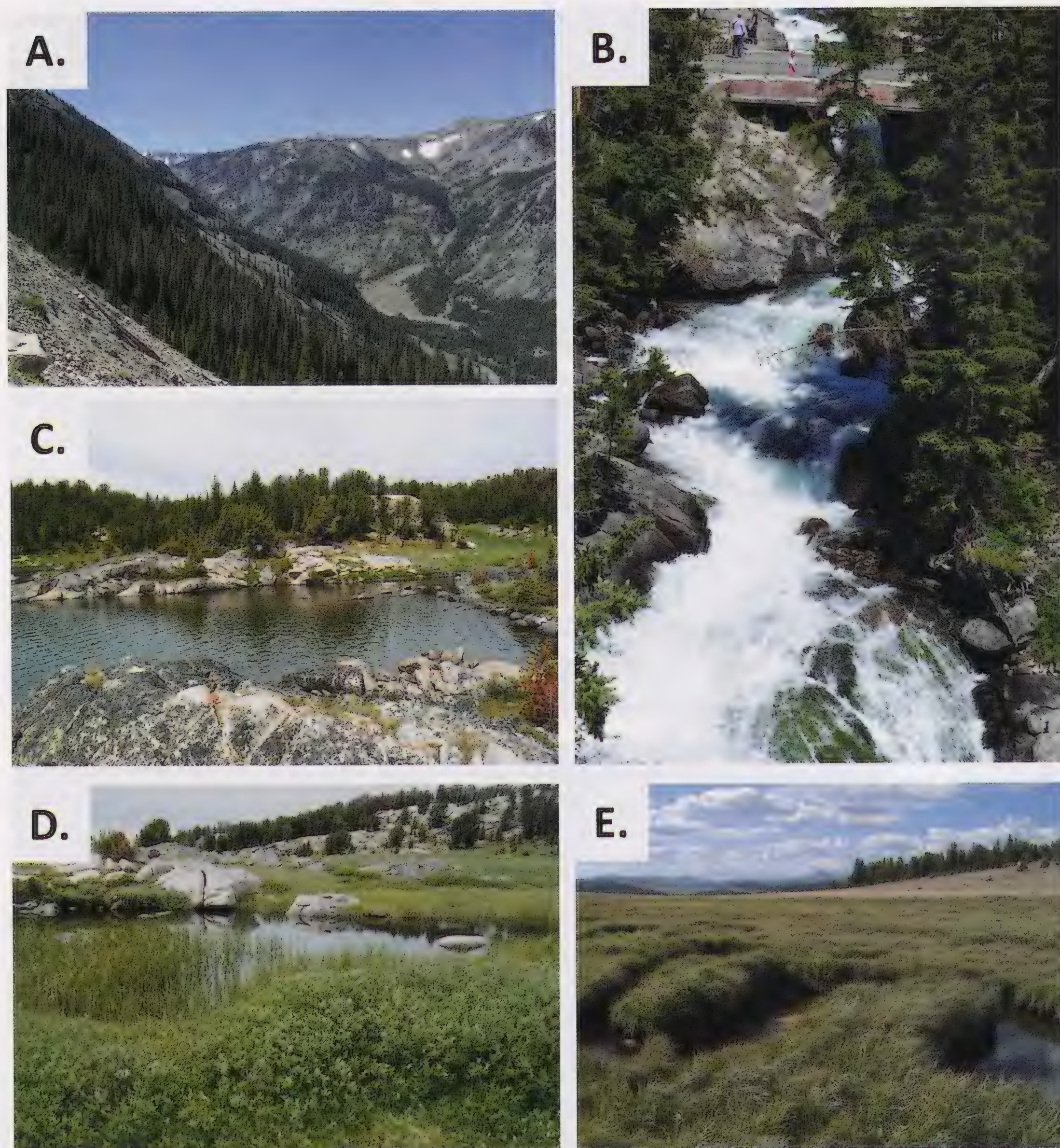


FIG. 4. Major biotic communities supporting bryophytes on the Beartooth Plateau at montane and subalpine elevations. A. Old-growth *Picea engelmannii* (+ *Abies lasiocarpa*) forest descending from subalpine north-western slope to the bottom of deep valley, elev. 2300–2900 m. Aug. 13, 2008. B. Creeks and streams crossing shady coniferous forests are hot spots for bryophyte biodiversity, and some of them can be home for rare species. On photo: spectacular rushing cataracts of Lake Creek on steep southern slope of the Plateau. In difficult to access splash zone on granite debris of the waterfalls *Philonotis yezoana* was discovered, a regionally rare moss of essentially oceanic habitats, elev. 2280 m. Aug. 3, 2010. C. Fantan Lake, east edge. Granitic ridges forested with *Pinus contorta* var. *latifolia*, *P. flexilis* and *Picea engelmannii*, elev. 2900 m. Jul. 26, 2010. D. Minerotrophic *Salix planifolia*/Bryidae fens are major communities supporting bryophytes at montane and subalpine elevations. On photo: boggy valley north-east of Fantan Lake, elev. 2900 m. Jul. 26, 2010. E. Sawtooth Fen on the Wyoming's Beartooth Plateau is the only palsa-type fen in conterminous United States. On photo: edge of the Fen, elev. 2950 m. Aug. 25, 2009.

(*Pentaphylloides floribunda* (Pursh) Á.Löve) and willows co-dominate.

The Beartooth Plateau has well-pronounced lacustrine features. Lakes with their numerous inlets

and outlets, riparian and peatland systems are very extensive (Figs. 3A–B, 4C–E). Most fens are circum-neutral minerotrophic fens. The majority of Beartooth fen sites formed in basin-filling processes (e.g.,

Rock Creek Fen, Mud Lake Fen, Clay Butte Fen, Ghost Creek Fen, Lake WGN Fen, Little Moose Lake Fen, and Sawtooth Palsa Fen), but there are also fens in a wide variety of sloping settings (e.g., Meadow Lake Fen, Lily Lake Fen, Fantan Fens, Little Bear Lake Fen, and Littlerock Creek Fen). Typically for the Rocky Mountain region, fens are seasonally flushed with abundant snow-melt water. Wyoming fens are often in glaciated mountain landscapes (Knight et al. 2014). One of such fens on the Beartooths is Sawtooth Palsa Fen (Fig. 4E). It has a dome shape, referred to as “palsa”. The fen lies in a broad subalpine basin underlain by deeply weathered Precambrian gneiss rock surrounded by Quarternary glacial deposits with a raised peat deposit and permafrost (Heidel et al. 2008, 2017). This is the only palsa fen, or remnant of true bog formed under past climates, in the contiguous United States (Collins et al. 1984).

Shrub and graminoid vegetation is widely spread in fens at elevations 2000–3300 m. Short-Fruit Willow (*Salix brachycarpa* Nutt.), Diamondleaf Willow, Wolf’s Willow (*S. wolfii* Bebb), and Resin Birch (*Betula glandulosa* Michx.) are usual dominants, and often associated with Northwest Territory Sedge (*Carex utriculata* Boott), Water Sedge (*C. aquatilis* Wahlenb. var. *aquatilis*), and Mountain Sedge. Ground layer dominated by bryophytes is typical for many Beartooth fens. Bryophytes act as foundational species in fens and largely control many ecosystem functions as well as form the majority of organic matter sequestered in many of these systems (Vitt 2014). *Sphagnum*-dominated associations are described in Fantan Fens, Ghost Creek Fen, East Lily Peatland, Little Bear Lake Fen, Littlerock Creek Fen and others. Circumboreal species *Sphagnum warnstorffii* Russow, *Aulacomnium palustre* (Hedw.) Schwägr., *Ptychostomum pseudotriquetrum* (Hedw.) J.R.Spence & H.P.Ramsay ex Holyoak & N.Pedersen, and *Tomentypnum nitens* (Hedw.) Loeske are consistently dominant, especially in aapamires of the subalpine zone, where they occur on the linear mounds. In swales and pools, *Sarmentypnum exannuatum* (Schimp.) Hedenäs and *Sphagnum platyphyllum* (Lindb. ex Braithw.) Sull. ex Warnst. are widespread. In alpine fens, the role of arctic-alpine taxa increases, e.g., *Oncophorus virens* (Hedw.) Brid., *Polytrichastrum alpinum* (Hedw.) G.L.Sm. var. *septentrionale* (Sw. ex Brid.) G.L.Sm., and *Sarmentypnum sarmentosum* (Wahlenb.) Tuom. & T.J.Kop. The detailed habitat data for each bryophyte taxon can be found in the original report (Kosovich-Anderson 2011a).

RESEARCH HISTORY

There has never been a systematic inventory of the bryophyte flora of the study area to date, but sporadic and short-term collecting was performed by visiting bryologists and local botanists. The oldest traceable specimen from the Wyoming’s Beartooth

Plateau was made in 1939. This collection of the most common moss on the Plateau, arctic-alpine *Tortula hoppeana* (Schultz) Ochyra (originally determined as *Desmatodon latifolius* (Hedw.) Brid. var. *muticus* (Brid.) Brid.) was made by an unknown collector; this specimen is at the University of Washington Herbarium (WTU).

Among the most notable early collectors of bryophytes of the Wyoming’s Beartooth Plateau were Elva Lawton, Winona H. Welch, Eula Whitehouse, Henry S. Conard, Frederick J. Hermann, and William A. Weber.

Elva Lawton visited the Wyoming’s Beartooth Plateau in 1953, at the starting point of her monumental project on mosses of the Pacific Northwest (Lawton 1971). From her trip during August 20–26 she returned with a trophy of interesting findings, like *Amblyodon dealbatus* (Hedw.) P.Beauv., *Pohlia longicolla* (Hedw.) Lindb. (both are regional rarities), *Coscinodon calyptratus* (Drumm.) C.E.O.Jensen, *Meiotrichum lyallii* (Mitt.) G.L.Merr., and *Mnium arizonicum* J.J.Amann (all three are endemics to the North American flora). As her team members, three other professional bryologists collected on the Beartooths: H.S. Conard, W.H. Welch, and E. Whitehouse. Beartooth Butte, Crazy Creek Valley, Beartooth Lake vicinity, and summits east of the Beartooth Lake were most intensively worked by this expedition. Many of their records, however, tended to gravitate towards the area adjacent to the Beartooth Pass (the present Hwy 212). The core of the Beartooth collections of Lawton’s research group is at WTU.

In 1965, Frederick J. Hermann briefly visited the Wyoming’s Beartooth Plateau. Of ten moss specimens, known to be collected by him in this area and kept at WTU, there was the endemic to North America *Homalothecium aeneum* (Mitt.) E.Lawton.

In 1973, William A. Weber, Professor of Botany from the University of Colorado and acute field observer, brought from the alpine zone of the Plateau a herbarium collection with another set of uncommon species: *Brachythecium turgidum* (Hartm.) Kindb., *Didymodon asperifolius* (Mitt.) H.A.Crum, Steere & L.E.Anderson, *Paraleucobryum enerve* (Thed.) Loeske, *Pohlia obtusifolia* (Vill. ex Brid.) L.F.Koch, and others (a total of more than 50 taxa). The duplicates of this extraordinary collection were distributed by W.A. Weber to herbaria of NY, RM, TENN and US, with voucher specimens deposited at COLO. Weber’s specimens were partially annotated by Patricia Eckel in 1980’s–1990’s. Some of the moss collections of 1950’s–1970’s were referenced in Eckel (1996).

There were very few studies of the Hepaticae of Wyoming before the 1960’s. In 1967, Won Shic Hong, the hepaticologist from the College of Great Falls, Great Falls, Montana, made his first of the series of more than 10 collecting trips throughout Wyoming. Major mountains in the northwestern part of the state were of his special attention. Thirteen

species and one variety of liverworts have been reported by Hong from the Wyoming's Beartooth Plateau, based on his collections from two mountain creeks, Lake Creek and Beartooth Creek (Hong 1977).

Among the most informative publications addressed to the bryophytes of the Wyoming's Beartooth Plateau, there was a technical report on the biology of fens in the Beartooth Mtns., by the WYNDD, which summarized the studies on Beartooth fens from 1962, and included the names of common and dominant mosses from 12 representative fens (Heidel et al. 2008). This list cites 36 species, including three liverworts, based on identification by Joe Elliott, Judy Harpel, and the present author.

A study worthy of note was the interdisciplinary work of Booth and Zygmunt (2005) that investigated the biogeography and comparative ecology of testate amoebae inhabiting *Sphagnum*-dominated peatlands in the Great Lakes and Rocky Mountain regions. As a result of this research, several species of *Sphagnum* – *S. angustifolium* (Russow) C.E.O.Jensen, *S. russo-wii* Warnst., *S. squarrosum* Crome, and *S. warnstorffii* (all determined by Richard Andrus) – have been reported from East Lily Peatland and Little Moose Lake Fen of the Wyoming's Beartooth Plateau.

Over the course of preparation for this project, it was possible to also involve small herbarium resources provided by my colleagues from the University of Wyoming (UW). About 50 of the contributed moss specimens, that had been brought from the Beartooth floristic expeditions in 2000's by B. Heidel (WYNDD), R.L. Hartman (RM), S.T. Jackson's palinology group, and the recent graduates of the UW Botany Department, B. and E. Elliott, have been taken into account in present studies. Recent collections and publications from the year 2000 and onward marked the beginning of the modern history of bryological explorations of the Wyoming's Beartooth Plateau.

METHODS

During four field seasons of July–August of 2008, 2009, 2010, and 2016 approximately 4400 bryophyte specimens (including about 800 specimens of liverworts and many packets containing multiple taxa) were collected, along with a herbarium of dominant, co-dominant, and typical vascular plants and lichens from sites where bryophytes were studied. Initial vascular plant identifications were made using Dorn (2001). The goal of systematic field sampling was to document as fully as possible the bryophyte species composition of the study area, with the emphasis on rare species. The alpine bryophyte flora was of special interest, since it was the most poorly documented in the state and the least studied. My attention has been largely focused on the east flank of the Plateau, the vast area of relatively accessible alpine sites.

Traditional specimen collecting methods were used. The coordinates and elevation were determined using a hand-held Global Positioning System (Garmin GPS set to UTM NAD 83). UTM's were also estimated by plotting the location using USGS topographic and aerial maps. Collection data recorded on herbarium specimens include legal location (township, range, and section), elevation, substrate, and habitat. Coordinates were recorded in 644 different locales; 149 sites were explored. Transportation on USFS roads during collecting trips was provided on personal RV vehicles and an ATV/four-wheeler (Fig. 5A). The length of hiking routes stretched to about 140 km. Initial specimen processing work was carried out in the improvised conditions of two USFS campgrounds, Island Lake Campground and Beartooth Lake Campground (Fig. 5B). Bryophyte collecting was authorized by the USFS.

All representative samples of habitat types have been attempted during collecting. However, certain parts of the Wyoming's Beartooth Plateau remain unvisited.

"Anyone acquainted with the topography of the Rocky Mountains must appreciate the fact that, given the terrain, the short seasons and the capricious weather phenomena, complete coverage of the major area is impossible in the short run." – Hermann (1987, p. 220).

Paucity or absence of collections from some areas of the Beartooth Plateau also reflects the intense seasonal activity of Grizzly (*Ursus arctos* L. subsp. *horribilis* Ord) and Black Bear (*Ursus americanus* Pal.) (Fig. 5C). The occurrence of large populations of both species is well reflected in the toponymy of the study area: Beartooth Plateau.

Information on all earlier bryophyte collections from the Wyoming's Beartooth Plateau was obtained prior to fieldwork. Many of the previously collected materials were reviewed by the author, particularly, the available portion of W.A. Weber's bryophyte collections, materials of S.T. Jackson's palynology group, and collections made by the WYNDD, RM, and USFS staff members in the 2000's, within the framework of the inventory project on the Beartooth Mtns. fens (Heidel et al. 2008, 2017). Individual specimens of different collectors from COLO were borrowed and have been examined.

Herbarium searches were conducted online for WTU. Collection records for bryophytes found in Wyoming and deposited in herbaria by searching the Consortium of Pacific Northwest Herbaria (CPNWH 2021) and the Consortium for North American Bryophyte Herbaria (CNABH 2021) data-based by January 2021, were also examined.

Identification of specimens has been accomplished using various moss and liverwort floras from North America and beyond (Savich-Lyubitskaya and Smirnova 1970; Lawton 1971; Flowers 1973; Crum and Anderson 1981; Nyholm 1986+; Damsholt 2002; Weber and Wittmann 2007, Flora of North America



FIG. 5. Working routine on an expedition to the Beartooths. A. Means of transportation and part of field equipment for bryophyte collecting in the bear country (including a rifle). B. Recently collected specimens hanging to dry at Beartooth Lake Campground. The same station used by Elva Lawton's research team in 1953. C. Grizzly bears habitually visiting Beartooth Lake Campground. Aug. 20, 2009. Photo by the author.

Editorial Committee 2007, 2014, *in prep.*, provisional publication, and others). Morphological techniques have been largely applied, along with chemical tests (KOH) on selective Pottiaceae specimens and methylene blue (1% aqueous) solution dying on *Sphag-*

num species identification. Three reference herbarium collections have been used: Grimmiaceae of Wyoming, RM (annotated by J. Muñoz), mosses of California, CAS (annotated by different authorities, provided by J.R. Shevock on specimen exchange program), and rare bryophyte taxa of Colorado, COLO (annotated by different authorities, provided by W.A. Weber). About 60% of previous identifications of the material cited in the present catalogue have been critically reviewed by the author in 2018–2020. Problematic collections were sent to taxonomy experts for verification or identification.

Voucher specimens are located in Kosovich-Anderson's personal herbarium in Cheyenne, WY, and UW Rocky Mountain Herbarium in Laramie, WY (RM). Duplicates of selective systematic groups were freely distributed to major herbaria for further phytogeographic, systematic, and genetic studies: Northern Arizona University, Flagstaff, AZ (ASC), State University of New York, Binghamton, NY (BING), California Academy of Sciences, San Francisco, CA (CAS), University of Colorado Museum, Boulder, CO (COLO), Duke University, Durham, NC (DUKE), Missouri Botanical Garden, Saint Louis, MO (MO), University of Montana, Missoula, MT (MONTU), University of California, Berkeley, CA (UC), United States National Herbarium of Smithsonian Institution, Washington D.C. (US), University of British Columbia, Vancouver, Canada (UBC), Main Botanical Garden, Russian Academy of Sciences, Moscow, Russia (MHA), Botanical Garden-Institute, Vladivostok, Russia (VBGI), University of Helsinki, Helsinki, Finland (H), Swedish Museum of Natural History, Stockholm, Sweden (S), and University of Bonn, Bonn, Germany (BONN). The shipping of specimens abroad was partially organized through the Missouri Botanical Garden and the University of Colorado.

RESULTS AND DISCUSSION

Wyoming's national forests lying in the high country of the Rocky Mountains harbor some of the greatest topographic variations, wettest climates and geological complexity of federal lands in the state, and therefore favor bryophyte diversity. The Beartooth Plateau in the SNF has one of the richest recorded bryophyte floras of Wyoming, even though large areas of the Plateau still remain under-surveyed. The uniqueness of the studied bryoflora is maintained by the high diversity of habitats, from arid granitic, limestone, sandstone, etc. outcrops and slopes to hydrophytic sites. This variation is caused by the ancient geological history of the country, climatic and hydrological features, the broad spectrum of vegetation communities, varied topography, the range of elevations (comprising of foothills, montane, subalpine, and alpine life zones), and generally low anthropogenic disturbance.

As a result of the analysis of the author's herbarium, along with materials of preceding re-

searchers, 282 species, four subspecies, and 22 varieties (totaling 308 bryophyte taxa) were registered in the bryoflora of the Wyoming's Beartooth Plateau. The information on the bryoflora is summarized in the catalogue and three appendices: Appendix 1 represents taxonomic diversity of bryophytes, Appendix 2 provides the list of excluded taxa, and Appendix 3 arranges the most frequent bryophytes by habitats.

Bryophytes belong to 131 genera and 53 families of two phyla: Hepaticae/Marchantiophyta, or hepatics/liverworts – 45 species, three subspecies, and four varieties from 29 genera and 20 families, and Musci/Bryophyta, or mosses – 237 species, one subspecies, and 18 varieties from 102 genera and 33 families. The most frequently collected family is Amblystegiaceae with 26 species, followed by Pottiaceae (23 species), Grimmiaceae (22 species), Brachytheciaceae and Dicranaceae (with 19 species in each), Bryaceae (17 species), Scapaniaceae (13 species), Mniaceae (12 species), Mielichhoferiaceae (11 species), and Sphagnaceae (10 species). The most richly collected genus is *Grimmia* Hedw. (12 species); species of *Grimmia* are mostly distributed in cold and mountain regions of the world, where rocky substrates are widespread. *Brachythecium* Schimp. and *Pohlia* Hedw. include 11 species each, *Sphagnum* L. (10 species), *Ptychostomum* Hornsch. (nine species), *Hygrohypnum* Lindb., *Scapania* (Dumort.) Dumort., *Schistidium* Bruch & Schimp., and *Syntrichia* Brid. (seven species each), and *Dicranum* Hedw., and *Mnium* Hedw. (six species each) (Appendix 1). The leading families and genera of the studied bryoflora form an important part of the vegetation in arctic, boreal, and high altitude floras around the Northern Hemisphere.

Ten taxa in the studied flora are endemics to North America. Seventy-one species, two subspecies and 10 varieties (15 species, two subspecies and two varieties of liverworts, and 56 species and eight varieties of mosses) have not previously been reported for Wyoming in *Flora of North America North of Mexico* (2007, 2014, *in prep.*, provisional publication) and by Stotler and Crandall-Stotler (2017). Three species – *Sphagnum miyabeianum* Warnst., *Syntrichia calcicola* J.J.Amann, and *S. virescens* (DeNot.) Ochyra – have not been included in *Flora of North America North of Mexico* (2007). The compiled list represents approximately 53% of the currently known bryophyte flora in Wyoming (Kosovich-Anderson unpublished data.). In total, 39 taxa (five liverwort species and 32 species and two varieties of mosses) listed in the catalogue are of potential conservation concern in Wyoming (Kosovich-Anderson 2011a).

The Plateau is the largest continuous area above 3000 m, and one of the largest alpine tundra regions in North America. The typical Central Rocky Mountains boreal-montane bryoflora is represented here by a large proportion of arctic-alpine, essentially arctic or alpine taxa. According to Marr et al. (2012),

the Beartooth Plateau is an alpine pereplain that hosts a number of arctic-alpine plant species that are disjunct between British Columbia and Colorado. In the bryophyte flora, these are: *Anthelia juratzkana* (Limpr.) Trevis., *Bartramia ithyphylla* Brid., *Brachythecium cirrosum* (Schwägr.) Schimp., *Campylopus schimperi* Milde, *Cephaloziella varians* (Gottsche) Steph., *Clevea hyalina* (Sommerf.) Lindb., and many others, totaling 69 species, one subspecies, and five varieties, or approximately 25% of the studied bryophyte flora. Interestingly, a highly specialized habitat for the Beartooth Plateau arctic-alpine bryophytes is provided by the fine-grained calcareous silt which is extruded in the form of “frost boils”, a topic to be developed in our upcoming papers (Kosovich-Anderson unpublished data).

In the catalogue there are also reported remarkable extensions of upper elevation limits in North America for 72 bryophyte taxa from the study area – 10 species of liverworts, as well as 60 species and two varieties of mosses. The new information essentially updates altitudinal ranges of the taxa, provided in *Flora of North America North of Mexico* (2007, 2014, *in prep.*, provisional publication).

Significant extensions of geographical distribution for many little-known or otherwise noteworthy species of bryophytes have been registered. Of these, 20 taxa – four liverworts, *Jungermannia borealis* Damsh. & Vána, *Saccobasis polita* (Nees) H.Buch, *Scapania hyperborea* Jørg., *S. scandica* (Arnell & H.Buch) Macvicar, and 16 mosses, *Brachythecium brandegeei* (Austin) H.Rob., *B. erythrorrhizon* Schimp. var. *alpinum* Kosovich-Anderson & Ignatov, *B. udum* I.Hagen, *Campylopus schimperi*, *Didymodon asperifolius*, *Kiaeria blyttii* (Bruch & Schimp.) Broth., *K. starkei* (F.Weber & D.Mohr) I.Hagen, *Plagiobryum zierii* (Dicks. ex Hedw.) Lindb., *Pohlia ludwigii* (Spreng. ex Schwägr.) Broth., *Pseudocalliergon angustifolium* Hedenäs, *P. turgescens* (T.Jensen) Loeske, *Rhizomnium andrewsianum* (Steere) T.J.Kop., *Sanionia nivalis* Hedenäs, *Sciuro-hypnum glaciale* (Schimp.) Ignatov & Huttunen, *Stegonia latifolia* (Schwägr.) Venturi ex Broth. var. *pilifera* (Brid.) Broth., and *Tayloria lingulata* (Dicks.) Lindb. – are restricted to the most northern and/or alpine habitats and reported from the upper elevations of Wyoming's Beartooth Plateau, are rare or rarely collected in the conterminous United States. The rare arctic-alpine species *Sciuro-hypnum glaciale* is a novelty for continental North America, with the nearest known localities being in Greenland. Its occurrence on the Wyoming's Beartooth Plateau extends the known range by no less than 4400 km, representing an extraordinary arctic-alpine disjunction in the Rocky Mountains (Kosovich-Anderson and Ignatov 2010). The other rare disjunct in Wyoming, *Plagiobryum zierii*, is probably relictual in the Rocky Mountains south of the glacial maximum. Presumably, the species reached its current distribution during the Pleistocene; populations south of the glacial ice sheets in the

Rockies survived in refugia such as Colorado and expanded north during the Holocene (Kosovich-Anderson and Weber 2011).

Two species of oceanic element, *Philonotis yezoana* Besch. & Cardot and *Sphagnum miyabeaenum* Warnst., are worthy of special mention. The Beartooths' occurrences of mosses with oceanic affinities are unusual in being so far inland and quite a distance east of the Continental Divide. These species were discovered approximately 1100–1150 km away from the nearest coast, in the interior mountains of the state, far east of their known major range in the Pacific West. This phenomenon, attributable to westerly winds that carry an oceanic climatic influence well inland to the northern Rocky Mountains, has been observed in both vascular plants and bryophytes (Schofield 1965; Ahti and Fagersten 1967). A huge and almost level area of the northwest-trending Plateau formation facilitates this floristic intrusion.

The materials of the present study were partially published (Kosovich-Anderson and Ignatov 2010, Kosovich-Anderson and Weber 2011, Kosovich-Anderson 2011b, c, 2015, 2019). In two projects, the author's specimens (*Sphagnum* and *Dicranum*) were involved in phylogenetic analyses (Shaw et al. 2014, 2015, Ignatova et al. 2015). Partially, the materials were used for the preparation of the recently published volume 28 of *Flora of North America North of Mexico* (Flora of North America Editorial Committee 2014). On the FNA distribution maps, seven taxa were indicated in Wyoming for the first time, based exclusively on the author's materials from the Wyoming's Beartooth Plateau. These are *Brachythecium brandegeei*, *Brachythecium erythrorrhizon* var. *alpinum*, *Hygrohypnum styriacum* (Limpr.) Broth., *Imbriobryum muehlenbeckii* (Bruch & Schimp.) N.Pedersen, *Plagiobryum zieri*, *Sciurohypnum glaciale*, and *Thuidium recognitum* (Hedw.) Lindb. So far, one new taxon – *Brachythecium erythrorrhizon* var. *alpinum* – was described (Kosovich-Anderson and Ignatov 2010).

Results from this work are proposed for use throughout the Rocky Mountains, as the first bryophyte flora of a national forest in the USFS Rocky Mountain Region (R2), to update a checklist of mosses and liverworts for the state of Wyoming, develop a prototype for the Wyoming bryophyte species of concern list, and inform prospective management designations for refugial habitats.

Catalogue of Bryophyte Flora

The catalogue is composed on the basis of approximately 4600 collections. Of these, 4400 were made by the author and approximately 200 by preceding researchers (H.S. Conard, B. and E. Elliott, S. Eversman, T.C. Frye, B. Heidel, R.L. Hartman, F.J. Hermann, E. Lawton, W.A. Weber, W. Welch, and E. Whitehouse). Additionally, the

information from published works has been used: Hong (1977), Booth and Zygmunt (2005), and Heidel et al. (2008, 2017). Some of the author's findings from the Beartooth Plateau have been published earlier (see above). The entire catalogue is represented for the first time in this publication.

In the catalogue, bryophyte species are arranged alphabetically within two principal bryophyte subdivisions – Hepaticae/Marchantiophyta and Musci/Bryophyta. Specific Latin name and the synonym (for some taxa) is followed by the date of first record for the study area, distribution (rare – taxon was encountered in 1–2 sites, sporadic – in 3–5 sites, frequent – in 6–10 sites, common – in >10 sites), and habitat preferences. The sites where the taxon occurs are arranged within five study quadrangles (in bold), with collection year, altitudinal data (“!” means updated upper altitudinal limit for North America), the representative specimen number and specimen location (if specimens are located in herbaria outside Wyoming) and “S+” means presence of sporophytes/capsules. For interesting taxa with limited distribution in the study area, more detailed labels are provided, with names of plant communities (the online Tropicos database [Tropicos 2021] was consulted to help clarify valid taxa for vascular plants). Herbarium citations are generally standard. Collection numbers are those of the author, except where otherwise stated. In old labels, “Road from Bear Tooth to Red Lodge”, “Rte 212”, “Cooke City to Red Lodge Highway”, or “Road to Red Lodge” mean Highway 212 and referred in text as [Hwy 212]; similarly, old name “Cody Road” is referred as [Hwy 296]. Also, an out-of-date spelling “Bear Tooth” has been corrected for “Beartooth”. Collections of S.T. Jackson's palynologists group are referred as to “*Jackson s.n.*”. Additional information, such as morphological features, geographic distributions, and altitudinal updates, are discussed in the Notes section of many taxa. Abbreviation “FNA” is used for *Flora of North America North of Mexico*.

The nomenclature and classification generally follow that of *Flora of North America North of Mexico* (2007, 2014, *in prep.*, provisional publication) and Synopsis of Liverwort Flora of North America North of Mexico (Stotler and Crandall-Stotler 2017). The asterisk “*” prior to Latin names of bryophytes means the taxon has not been reported for Wyoming in the above mentioned publications. The double asterisk “**” means the taxon is of potential conservation concern in Wyoming (Kosovich-Anderson unpublished data.). Endemics to the North American flora are marked with “E”. NatureServe (2021) was consulted to help clarify formal rarity assessment for some species.

Some taxa were left unlisted: revision of forms of *Philonotis fontana* (Hedw.) Brid. s.l., *Sarmentypnum exannulatum*, the subgenera *Acutifolia* (Russow) A.J.Shaw and *Subsecunda* (Lindb.) A.J.Shaw of the genus *Sphagnum*, and the *ruralis* group of the genus *Syntrichia* Brid., that occur in this part of the Rocky

Mountains, is necessary. Poorly-studied liverwort taxa (e.g., Gymnomitriaceae spp.) were also left beyond the scope of the catalogue. Species which can be identified only if gametangia or sporophytes are present (e.g., Pelliaceae spp., Orthotrichaceae spp., and Bryaceae spp.) also tend to be under-recorded. In terms of the genus *Philonotis* Brid., I maintain *P. caespitosa* Jur., the specific status of which have been confirmed by the molecular phylogenetic studies by Koponen et al. (2012). In treatment of the genus *Syntrichia*, I follow Gallego et al. (2006) and Kellman (2009).

The catalogue has been revised to exclude collections not actually made from the Beartooth Plateau (e.g., many records from the Clarks Fork of Yellowstone River, which are technically from the North Absaroka area).

HEPATICA

Anthelia juratzkana (Limpr.) Trevis.

First record: 1973. Sporadic; in late snow-melt zone, forms mats and crusts on rocks and moist peaty soil along lakes and streams; arctic-alpine.

Beartooth Butte: boggy shore of Island Lake, 2008, 9500 ft, 2365. **Deep Lake:** [Hwy 212], W side, on steep slope N of switchback, 1973, 3200 m.s.m., *Weber B-44321* (COLO, RM); inlet of Frozen Lake, 2008, 10,500 ft, 2556; unnamed alpine lake S of Hwy 212, 2008, 10,000 ft, 2668 (MO, VBGI), det. V. Bakalin.

* ***Apopellia alpicola*** (R.M.Schust. ex L.Söderstr., A.Hagborg & von Konrat) Nebel & D.Quandt

First record: 2009. Rare, single collection from subalpine zone; arctic-alpine.

Deep Lake: 4WD Rd 149, Sawtooth Lake, boggy shore, on wet soil in shaded niche between rocks, 2009, 9200–9250 ft, 6039 (MO, VBGI), initial det. V. Bakalin as *Pellia endiviifolia* (Dicks.) Dumort.

Note: A taxon with poorly known distribution in North America. “This species is verified only from arctic-alpine areas of northwest Canada, including the Northwest Territories, the Yukon, British Columbia, and Alberta. It is often reported as *Pellia endiviifolia*...” (Stotler and Crandall-Stotler 2017, p. 584).

Barbilophozia barbata (Schmidel ex Schreb.) Loeske

First record: 2010. Sporadic; on boulders and logs, or among other mosses on duff in coniferous forests, fens, and wet grasslands, from foothills through the alpine.

Jim Smith Peak: Crazy Creek-2, 2010, 6900 ft, 7966. **Beartooth Butte:** 4WD Rd 149: NE slope, subalpine meadow, 2010, 9650 ft, 7050. **Deep Lake:** summits: Gravel Pit vicinity, alpine fen, 2010, ! 10,300–10,400 ft (3140–3170 m), 7293.

Note: Altitudinal update – 3170 m vs. “0–1000 m” (FNA *in prep.*, provisional publication).

Barbilophozia hatcheri (A.Evans) Loeske

First record: 2008. Common; on soil in tundra and subalpine and alpine fens, willow wetlands, on humus, logs and rocks, often in deep shade, in old-growth montane and subalpine fir-spruce forests, in streamsides, from foothills through the alpine; essentially arctic-alpine, subarctic-subalpine to boreal montane. Gemmae common.

Jim Smith Peak: Ivy Lake, SE edge, 2010, 8000 ft, 7553 (MO, VBGI), det. V. Bakalin, gemm.; Crazy Creek-2, 2010, 6900 ft, 7945, gemm. **Muddy Creek:** Lake Creek-1, 2010, 7650–7700 ft, 7157, gemm. **Beartooth Butte:** boggy shore of Island Lake, 2008, 9500 ft, 2373; Beauty Lake Trail, 2009, 8900 ft, 5221, gemm.; Beartooth Lake CG: coniferous forest, 8900 ft, 2009, 6213. **Deep Lake:** sky-lift scenic point, alpine tundra, 2008, ! 10,850–10,900 ft (3300–3320 m), 2356, gemm.; summits: alpine tundra-3, 2008, 10,350 ft, 2412; inlet of Frozen Lake, 2008, 10,500 ft, 2545; summits: alpine fen-1, 2008, 10,500 ft, 3269; Wyoming Creek-1, 2008, 10,300 ft, 3479, gemm.; head of unnamed creek-1, 2010, 10,250 ft, 6747 (MO, VBGI), det. V. Bakalin, gemm.; Long Lake, NW slope, willow wetlands, 2010, 9750 ft, 8294, gemm.

Note: Altitudinal update – 3320 m vs. “300–3000 m” (FNA *in prep.*, provisional publication).

Barbilophozia lycopodioides (Wallr.) Loeske

First record: 2008. Frequent; mainly on forest floor and rock ledges in mature undisturbed moist coniferous forests, from montane through subalpine elevations; arctic-alpine or high subarctic-subalpine.

Jim Smith Peak: Ivy Lake, SE edge, 2010, 8000–8100 ft, 7539 (US), det. R. Ireland. **Muddy Creek:** Lake Creek-1, 2010, 7700 ft, 7143. **Beartooth Butte:** boggy shore of Island Lake, 2008, 9500 ft, 2378; Beauty Lake Trail, 2009, 8950 ft, 5210 (CAS, COLO, MO, VBGI), ver. V. Bakalin; Beartooth Lake CG: spruce forest, 2009, 8950 ft, 6219. **Deep Lake:** Top Lake Fen-1, 2009, ! 9450 ft (2880 m), 5781 (MO, VBGI), det. V. Bakalin, gemm.

Note: In my experience, this is the largest leafy liverwort on the Beartooth Plateau; well-developed plants being 4–5 mm wide and 5–8 cm long. Altitudinal update – 2880 m vs. “0–1500 m” (FNA *in prep.*, provisional publication).

Blepharostoma trichophyllum (L.) Dumort.

First record: 1977. Common; on shaded rocks, peaty banks, on thin soil over ledges and decaying wood in forests, in filtered light, from montane through the alpine.

Muddy Creek: Lake Creek (Hong 1977); Lily Lake Swamp Forest, 2008, 7700 ft, 3039; Ghost Creek Fen, 2008, 7900 ft, 3753. **Beartooth Butte:** Little Bear Creek-1, 2008, 9700 ft, 2694 (MO, VBGI), det. V. Bakalin; pine forest along Hwy 212, 2008, 8950 ft, 3916; Beauty Lake Trail, 2009, 8900 ft, 5211; Long Lake: E shore, 2010, 9600 ft, 6813; Fantan Lake: E shore, 2010, 9500 ft, 6879; Chain Lake: S shore, 2010, 9500 ft, 6998 (MO, VBGI), ver. V. Bakalin; Long Lake: S edge, 2010, 9650 ft, 8307 (MO, VBGI), det. V. Bakalin. **Deep Lake:** unnamed alpine lake S of

Hwy 212, 2008, 10,000 ft, 2666; summits: alpine fen-4, 2008, 10,400 ft, 3310; Sawtooth Lake, 2009, 9300 ft, 5982; Gravel Pit vicinity, alpine tundra, 2010, 10,350 ft, 7292; Top Lake Fen-2, 2010, 9450 ft, 7741 (MO, VBGI), ver. V. Bakalin. **Black Pyramid Mountain:** WY-MT state line: unnamed lake, 2010, 9800 ft, 8092 (MO, VBGI), ver. V. Bakalin.

* ** **Calypogeia neogaea** (R.M.Schust.) Bakalin

First record: 2008. Sporadic; on boggy and loamy soil near subalpine and alpine lakes and streams.

Beartooth Butte: Little Bear Creek-1, 2008, 9700 ft, 2684; boggy valley near small subalpine lake, 2010, 9500 ft, 6853 (MO, VBGI), det. V. Bakalin. **Deep Lake:** alpine lake along Hwy 212, boggy shore, 2008, 10,000 ft, 2672 (MO, VBGI), det. V. Bakalin.

Note: A rare disjunct in Wyoming (Kosovich-Anderson unpublished data). "This species is from California, and in eastern North America from Texas, Arkansas, and southern Illinois to Florida and north to New York and New England" (Stotler and Crandall-Stotler 2017, p. 591).

Cephalozia bicuspidata (L.) Dumort.

First record: 2008. Frequent; on shaded rocks of creek banks, rotten logs in old-growth coniferous forests, on rich soil under tall herbs, on wet peaty soil along trails in alpine wetlands and fens.

Beartooth Butte: Little Bear Lake Fen, 2008, 9600 ft, 2838 (MO, VBGI), det. V. Bakalin; Beartooth Lake: W-SW shore, 2010, 8850 ft, 6625; Long Lake: E shore, 2010, 9600 ft, 6782 (MO, VBGI), det. V. Bakalin. **Deep Lake:** unnamed lake S of Hwy 212, 2008, 10,000 ft, 2662; summits: small alpine lake, 2008, 10,500 ft, 3506; Canyon Creek, 2009, 9400 ft, 5655 (MO, VBGI), det. V. Bakalin; creek connecting Dollar and Sawtooth Lakes, 2009, 9400 ft, 5790 (MO, VBGI), det. V. Bakalin; head of unnamed creek-1, 2010, 10,250 ft, 6756 (MO, VBGI), det. V. Bakalin; tributary of Canyon Creek-2, 2010, 9400 ft, 7780 (MO, VBGI), det. V. Bakalin; head of unnamed creek-2, 2010, 10,300 ft, 8229.

Cephaloziella divaricata (Sm.) Schiffn.

First record: 2008. Common; on different kinds of soil, often between rocks, in alpine tundra and fens, subalpine forests and meadows, also in relatively xeric areas in montane zone.

Muddy Creek: Lake Creek CG: wet coniferous forest, 2009, 6950 ft, 5911 (MO, VBGI), det. V. Bakalin.

Beartooth Butte: boggy shore of Island Lake, 2008, 9500 ft, 2358; Little Bear Lake Fen, 2008, 9600 ft, 2768; 4WD Rd 149: NE slope, subalpine meadow, 2010, 8200 ft, 7052. **Deep Lake:** summits: alpine tundra-3, 2008, 10,350 ft, 2408; unnamed alpine lake S of Hwy 212, 2008, 10,000 ft, 2665; summits: alpine fen-5, 2008, 10,750 ft, 3450; summits: small alpine lake, 2008, 10,500 ft, 3519; Littlerock Creek Fen, 2008, 10,650 ft, 3673; Canyon Creek valley: subalpine meadow, 2010, 9450 ft, 7768 (MO, VBGI), det. V. Bakalin. **Black Pyramid Mountain:** summits: alpine tundra-4, 2008, 10,300 ft, 2459.

Cephaloziella varians (Gottsche) Steph.

[*Cephaloziella arctica* Bryhn & Douin ex Müll.Frib.] First record: 2008. Sporadic; on damp and peaty soil in fens and along creeks, in rock crevices on ledges, from montane through alpine elevations; arctic-alpine.

Jim Smith Peak: Crazy Creek-2, 2010, 6900 ft, 7980 (MO, VBGI), det. V. Bakalin. **Deep Lake:** inlet of Frozen Lake, 2008, 10,500 ft, 2551; summits: alpine fen-5, 2008, 10,750 ft, 3461; Littlerock Creek Fen, 2008, 10,650 ft, 3636.

Chiloscyphus pallescens (Ehrh. ex Hoffm.) Dumort.

First record: 2008. Frequent; on wet rocks along streams and streamlets in forested areas, from montane through the subalpine.

Jim Smith Peak: Crazy Creek CG Swamp, 2008, 6950 ft, 3189. **Muddy Creek:** Lily Lake Fen, 2008, 7700 ft, 3062; Ghost Creek Fen, 2008, 7900 ft, 3745; tributary of Beartooth Creek-1, 2010, 8400 ft, 7107.

Beartooth Butte: pine forest along Hwy 212, 2008, 8950 ft, 3909; Beartooth Falls, 2009, 8900 ft, 5452.

Chiloscyphus polyanthos (L.) Corda

- var. **polyanthos**

First record: 1977. Sporadic; in forested areas on rocks close to springs and in streams, just above water and fully submerged, from montane through the subalpine.

Muddy Creek: Lake Creek (Hong 1977); Lily Lake Fen, 2008, 7700 ft, 3081; Ghost Creek Fen, 2008, 7900 ft, 3747 (MO, VBGI), det. V. Bakalin.

Beartooth Butte: Beartooth Creek (Hong 1977); Fantan Lake: N shore, 2010, 9500 ft, 7015.

* - var. **rivularis** (Schrad.) Nees

First record: 2010. Rare, single collection from montane zone.

Muddy Creek: Muddy Creek-2, coniferous forest, on rocks fully submerged in running water of creek, 2010, 7700 ft, 7245 (MO, VBGI), det. V. Bakalin.

* **Clevea hyalina** (Sommerf.) Lindb.

[*Athalamia hyalina* (Sommerf.) S.Hatt.]

First record: 2010. Rare, single collection from subalpine zone; arctic-alpine.

Beartooth Butte: Beartooth Lake CG, *Picea engelmannii* forest, seasonally dry stream, on wet loamy soil on the base of spruce, assoc.: *Pohlia cruda* (Hedw.) Lindb., 2010, 8950–9000 ft, 8026, with multiple carpocephala.

Conocephalum salebrosum Szweyk., Buczk. & Odrzyk.

First record: 2009. Frequent; on clay or rocks along creeks in forests, in small streams, waterfalls, on soil in willow thickets in flood valleys, from foothills through the subalpine.

Muddy Creek: Lake Creek CG: wet coniferous forest, 2009, 6950 ft, 5900 (MO, VBGI), ver. V. Bakalin; Beartooth Creek-3, 2010, 7550 ft, 7421; Gilbert Creek-2, 2010, 6900 ft, 8007. **Beartooth Butte:** Beauty Lake Trail, 2009, 8900 ft, 5251; Beartooth Falls,

2009, 8900 ft, 5466; Beartooth Lake: W-SW shore, 2010, 8900 ft, 6628.

Note: A recently described species related to the widespread *Conocephalum conicum* (L.) Dumort., distinguished on a genetic and morphologic basis (Szweykowski et al. 2005). *Conocephalum conicum* is predominantly a boreal-temperate European-Siberian species collected more often below 600 m and not found above 1080 m, whereas *C. salebrosum* can be characterized as an arctic-boreal circumpolar species known from higher elevations (Borovichev et al. 2009). Sporadically distributed in Wyoming at foothills through subalpine elevations (Kosovich-Anderson unpublished data). Formerly, the species was reported for the state as *C. conicum* (Porter 1933; Hong 1977).

Fuscocephaloziopsis lunulifolia (Dumort.) Vána & L.Söderstr.

[*Cephalozia lunulifolia* (Dumort.) Dumort.]

First record: 1977. Rare, two collections of Hong from montane zone.

Muddy Creek: Lake Creek, Hong 31189, 31192 (Hong 1977).

Note: Altitudinal update – approx. 2100–2300 m on the Beartooth Plateau vs. “low to moderate [0–1599 m]” elevation (FNA *in prep.*, provisional publication).

Fuscocephaloziopsis pleniceps (Austin) Vána & L.Söderstr.

[*Cephalozia pleniceps* (Austin) Lindb.]

First record: 1973. Common; in coniferous forests, on bare soil and peat, on slightly acidic substrates – along trails, banks of streams, on lake shores among rocks, on sides of tussocks, from montane through the alpine.

Jim Smith Peak: Rock Creek Fen (Heidel et al. 2008); Rock Creek, 2016, 7700 ft, 21015. **Muddy Creek:** Lake Creek (Hong 1977); Lily Lake Swamp Forest, 2008, 7700 ft, 3038; Ghost Creek Fen, 2008, 7900 ft, 3745. **Beartooth Butte:** Little Bear Lake Fen, 2008, 9600 ft, 2764; Beartooth Lake CG: wet subalpine meadow, 2009, 8950 ft, 4904; Beauty Lake Trail, 2009, 8800 ft, 5305; Beartooth Lake, W-SW shore, 2010, 8850 ft, 6625 (MO, VBGI), det. V. Bakalin; Long Lake: E shore, 2010, 9600 ft, 6781; boggy valley NE of Fantan Lake, 2010, 9500 ft, 6834; Chain Lake: S shore, 2010, 9500 ft, 7002. **Deep Lake:** [Hwy 212], W side, steep slope N of switchback, 1973, 3200 m.s.m., Weber B-44322 (COLO, RM); inlet of Frozen Lake, 2008, 10,500 ft, 2576; Littlerock Creek Fen, 2008, 10,650 ft, 3588; head of unnamed creek-1, 2010, 10,250 ft, 6754; Lower Top Lake Fen, 2010, 9450 ft, 7687; Top Lake Fen-2, 2010, 9450 ft, 7737 (MO, VBGI), det. V. Bakalin.

Gymnocolea inflata (Huds.) Dumort.

First record: 1973. Frequent; wet cliffs on lake shores, a co-dominant species in subalpine fens and meadows, in shallows or around the edges of rock

pools, on igneous rocks in seepage areas, on rills and snowbeds, from montane through the alpine.

Jim Smith Peak: Rock Creek Fen (Heidel et al. 2008). **Muddy Creek:** tributary of Beartooth Creek-1, 2010, 8400 ft, 7106. **Beartooth Butte:** boggy shore of Island Lake, 2008, 9500 ft, 2373 (MO, VBGI), det. V. Bakalin; Little Bear Lake Fen, NW portion, 2008, 9600 ft, 2744; Beartooth Lake CG: wet subalpine meadow, 2009, 8950 ft, 4904. **Deep Lake:** W side of Beartooth Pass, under late snow patch, 1973, 3200 m.s.m., Weber B-44308 (NY).

* **Harpanthus flotovianus** (Nees) Nees

First record: 2009. Sporadic; on boggy and gravelly soil and wet non-calcareous rocks along stream banks and lakeshores, at subalpine elevations.

Beartooth Butte: boggy valley: small subalpine lake, 2010, 9500 ft, 6904 (MO, VBGI), det. V. Bakalin; Fantan Lake: N shore, 2010, 9500 ft, 7032. **Deep Lake:** Sawtooth Lake, 2009, 9200 ft, 6007; creek connecting Lower Top and Sawtooth Lakes, 2010, 9450 ft, 7640 (MO, VBGI), det. V. Bakalin.

* ****Jungermannia borealis** Damsh. & Vána

First record: 2008. Sporadic; on damp soil and sheltered rocks, on lake banks, at upper subalpine and alpine elevations; arctic-alpine.

Beartooth Butte: boggy valley: small subalpine lake, 2010, 9500 ft, 6844 (MO, VBGI). **Deep Lake:** two small lakes along Hwy 212, 2008, ! 10,000 ft (3050 m), 2668 (MO, VBGI); unnamed lake along Hwy 212, 2010, ! 10,000 ft (3050 m), 8255 (MO, VBGI). All det. V. Bakalin.

Note: This species is a rare disjunct in Wyoming (Kosovich-Anderson unpublished data). In Vána and Hong (1999), distribution in western North America includes Alaska and British Columbia. Occurs “on shaded rocks and soil near streams, snowbed habitats, mostly unforested areas; elevation unknown; Greenland; B.C., Nunavut; Alaska, Calif.; Eurasia” (FNA *in prep.*, provisional publication). Altitudinal update – on the Beartooths, the species was registered at elevations 2900–3050 m.

Jungermannia exsertifolia Steph.

- **subsp. cordifolia** (Dumort.) Vána

[*Jungermannia eucordifolia* Schljakov]

First record: 2008. Frequent; on wet rocks near streams, waterfalls, along pools in fens, at subalpine and alpine elevations.

Beartooth Butte: Little Bear Creek-1, 2008, 9700 ft, 2687 (MO, VBGI); Little Bear Creek-3, 2009, 9400 ft, 5324 (MO, VBGI). **Deep Lake:** Sawtooth Lake, 2009, 9200–9250 ft, 6058 (MO, VBGI); head of unnamed creek-1, 2010, 10,200 ft, 6736 (MO, VBGI); tributary of Canyon Creek-2, 2010, 9400 ft, 6778 (MO, VBGI); Lower Top Lake Fen, 2010, 9450 ft, 7655 (MO, VBGI). All det. V. Bakalin.

Lepidozia reptans (L.) Dumort.

First record: 1977. Rare, at montane elevations.

Muddy Creek: Lake Creek (Hong 1977); headwaters of Ghost Creek, Ghost Creek Fen, ecotone zone

between *Carex* spp. fen and swampy *Picea engelmannii* (+ *P. glauca*) forest, on duff and rotten wood, 2008, 7900 ft, 3753.

Lophocolea heterophylla (Shrad.) Dumort.

First record: 2008. Rare, single collection from subalpine zone.

Beartooth Butte: Hwy 212, S-facing slope, *Pinus contorta* var. *latifolia* forest, shaded brook bank, on wet sandy-clayey soil, 2008, 9000 ft, 3902a, gemm.

Lophocolea minor Nees

First record: 1977. Rare, single collection from montane zone.

Muddy Creek: Lake Creek, Hong 31207 (Hong 1977).

Lophozia silvicola H.Buch

[*Lophozia ventricosa* var. *silvicola* (H.Buch) E.W.Jones]

First record: 1977. Rare, two collections of Hong, elevation unknown.

Beartooth Butte: Beartooth Creek, Hong 31177, 31184 (Hong 1977).

Lophozia ventricosa (Dicks.) Dumort.

- var. ventricosa

First record: 1977. Common; on rotten logs and trunks in coniferous forests, sporadically on rocks and soil of stream and lake banks, often among mosses, from montane through the alpine. Gemmae common.

Muddy Creek: Ghost Creek Fen, 2008, 7900 ft, 3753, gemm. **Beartooth Butte:** Beartooth Creek (Hong 1977); Island Lake CG: spruce forest, 2008, 9500 ft, 2216, gemm.; boggy shore of Island Lake, 2008, 9500 ft, 2373 (MO, VBG), det. V. Bakalin, gemm.; Clay Butte foothills: coniferous forest, 2009, 9000 ft, 5393; Beartooth Lake CG, coniferous forest, 2009, 8900 ft, 6217; Chain Lake: S shore, 2010, 9500 ft, 6998, gemm. **Deep Lake:** unnamed alpine lake S of Hwy 212, 2008, 10,000 ft, 2678 (MO, VBG), det. V. Bakalin, gemm.; Wyoming Creek-2, 2009, 10,600 ft, 5061, gemm.; Sawtooth Palsa Fen, 2009, 9700 ft, 5741, gemm.; Top Lake Fen-1, 2009, 9450 ft, 5781; head of unnamed creek-1, 2010, 10,250 ft, 6747, gemm.; Lower Top Lake Fen, 2010, 9450 ft, 7687, gemm.

*** - var. longiflora** (Nees) Macoun

First record: 2008. Rare; on wet soil in boggy forested areas, on humus soil along creek, in montane zone.

Muddy Creek: Lily Lake Swamp Forest, 2008, 7700 ft, 3031 (MO, VBG); Lake Creek-1, 2010, 7700 ft, 7163 (MO, VBG), per. All det. V. Bakalin.

Lophozia wenzelii (Nees) Steph.

First record: 1965. Sporadic; in alpine meadows and fens, boggy banks of creeks, on wet soil and rocks; essentially arctic-alpine.

Deep Lake: unnamed alpine lake S of Hwy 212, 2008, 10,000 ft, 2678; Wyoming Creek-2, 2009, 10,600 ft,

5026. **Unclear location:** Beartooth Pass, 1965, Hermann 20072 (RM, cited in: Hong 1977).

Marchantia polymorpha L.

*** - subsp. montivagans** Bischl. & Boissel.-Dub.

[*Marchantia alpestris* (Nees) Burgeff]

First record: 2008. Common; seepage areas in forests, in shaded niches along streamsides and lake shores on clayey, sandy, gravelly and peaty soil, on silty banks in willow thickets, from foothills through the alpine; essentially arctic-alpine.

Jim Smith Peak: Rock Creek, 2016, 7700 ft, 21019.

Muddy Creek: Lily Lake Swamp Forest, 2008, 7700 ft, 3032; Lily Lake Fen, 2008, 7700 ft, 3088, gemm.; Ghost Creek Fen, 2008, 7900 ft, 3747; Muddy Creek-1, 2009, 8100 ft, 6140; Lewis and Clark Trail vicinity: swampy mixed forest, 2009, 6550 ft, 6202, gemm.; tributary of Beartooth Creek-1, 2010, 8450 ft, 7106 (MO, VBG), det. V. Bakalin; Gilbert Creek-2, 2010, 6900 ft, 8017; "Beaver Lake", 2010, 7300 ft, 8322.

Beartooth Butte: Little Bear Lake Fen, 2008, 9600 ft, 2843, gemm.; Little Bear Creek-2, 2008, 9500 ft, 3253; creek SW of Beartooth Butte, 2008, 9500 ft, 3858; Clay Butte foothills: coniferous forest, 2009, 9000 ft, 5416; Beartooth Falls, 2009, 8900 ft, 5451; Beartooth Lake: W-SW shore, 2010, 8900 ft, 6653; Fantan Lake: N shore, 2010, 9500 ft, 7027. **Deep Lake:** inlet of Frozen Lake, 2008, 10,500 ft, 2632; Wyoming Creek-1, 2008, 10,300 ft, 3478; Sawtooth Palsa Fen, 2009, 9700 ft, 5743; Sawtooth Lake, 2009, 9300 ft, 6007; head of unnamed creek-1, 2010, 10,200 ft, 6758, gemm.; tributary of Canyon Creek-1, 2010, 9900 ft, 6766.

*** - subsp. ruderalis** Bischl. & Boissel.-Dub.

[*Marchantia latifolia* Gray]

First record: 1977. Sporadic; on bare soil, both mineral and peaty, on disturbed or naturally denudated places, along streamsides, from foothills through the subalpine.

Jim Smith Peak: Crazy Creek CG Swamp, 2008, 7000 ft, 3191, gemm. **Muddy Creek:** Lake Creek, Hong 31197, 31199 (Hong 1977); Gilbert Creek-2, 2010, 6900 ft, 8017 (½) (CAS), gemm. **Beartooth Butte:** Beartooth Creek (Hong 1977); Little Bear Lake Fen, edge of fen, roadside slope, 2008, 9600 ft, 2751, gemm.

Nardia geoscyphus (DeNot.) Lindb.

First record: 2008. Sporadic; on soil over rocks, on damp peaty soil and gravel along streams, on sides of sedge tussocks at lake shore; in upper subalpine and alpine zones; essentially arctic-alpine.

Beartooth Butte: Little Bear Lake Fen, 2008, 9600 ft, 2758; unnamed creek/"Dichelyma Creek-2", 2010, 9550 ft, 6971 (MO, VBG), det. V. Bakalin. **Deep Lake:** head of unnamed creek-1, 2010, 10,200 ft, 6746; unnamed lake along Hwy 212, 2010, 10,000 ft, 8254 (½) (MO, VBG), det. V. Bakalin.

*** Pellia neesiana** (Gottsche) Limpr.

First record: 2008. Frequent; in wet sites, including streamsides, willow carrs, and edges of pools, at subalpine elevations.

Beartooth Butte: boggy shore of Island Lake, 2008, 9500 ft, 2388; Little Bear Creek-1, 2008, 9700 ft, 2708; Little Bear Lake Fen, 2008, 9600 ft, 2750; Fantan Lake: N shore, 2010, 9500 ft, 7019 (MO, VBGI), det. V. Bakalin. **Deep Lake:** Canyon Creek, 2009, 9400 ft, 5686 (MO, VBGI), det. V. Bakalin; Sawtooth Lake, waterfall, 2009, 9250 ft, 6039.

* **Plagiochila porelloides** (Torr. ex Nees) Lindenb.

First record: 2008. Sporadic; in forests and swamps on duff, soil, fallen logs, among rocks in rock fields, from foothills through the montane.

Jim Smith Peak: Crazy Creek CG Swamp, 2008, 7000 ft, 3169; Crazy Creek-2, 2010, 6900 ft, 7942 (MO, VBGI), det. V. Bakalin. **Muddy Creek:** Lake Creek Waterfalls, 2009, 7500 ft, 5840 (MO, VBGI), det. V. Bakalin; Lake Creek CG: wet coniferous forest, 2009, 6950 ft, 5897.

Radula complanata (L.) Dumort.

First record: 2010. Rare; on rock outcrops and on soil among rocks along lake and creek, on trunks in willow wetlands, in foothills and montane zones.

Jim Smith Peak: Ivy Lake: SE edge, 2010, 8100 ft, 7551 (MO, VBGI), det. V. Bakalin; Crazy Creek-2, 2010, 6900 ft, 7956.

Riccardia latifrons (Lindb.) Lindb.

First record: 1977. Sporadic; on boggy soil along creeks and on moist clayey soil in graminoid fen.

Muddy Creek: Lake Creek, *Hong 31192* (Hong 1977); Mud Lake Fen, 2008, 7700 ft, 3136. **Beartooth Butte:** Beartooth Creek, *Hong 31163* (Hong 1977).

* **Riccardia palmata** (Hedw.) Carruth.

First record: 1977. Rare, single collection from montane elevation.

Muddy Creek: Lake Creek, *Hong 31206* (Hong 1977).

* ** **Saccobasis polita** (Nees) H.Buch

[*Tritomaria polita* (Nees) Jørg.]

First record: 2010. Rare; on soil over rocks in springy meadows along lakes in upper subalpine zone; arctic-alpine.

Beartooth Butte: Long Lake: E shore, 2010, ! 9600 ft (2930 m), 6810 (MO, VBGI); Fantan Lake: E shore, 2010, 9500 ft, 6897 (MO, VBGI). All det. V. Bakalin. Note: An infrequent disjunct in high mountains of Colorado and Wyoming (Hermann 1987; Weber and Wittmann 2007; Kosovich-Anderson unpublished data). According to Stotler and Crandall-Stotler (2017, p. 681), it is “found in Alaska, the Yukon, and British Columbia in the west, and from Greenland and Nunavut south to Quebec in the east. It is also in Great Britain and in northern to central Europe, especially in montane habitats”. Altitudinal update – 2930 m vs. “500–1100 m” (FNA *in prep.*, provisional publication).

* ** **Scapania hyperborea** Jørg.

First record: 2010. Rare, single collection from alpine zone; arctic or arctic-alpine.

Deep Lake: unnamed alpine lake along Hwy 212, on boggy soil, assoc.: *Nardia geoscyphus*, 2010, 10,000 ft, 8254 (½) (MO, VBGI), det. V. Bakalin.

Note: A rare species with predominantly arctic distribution; in western United States was previously known from Alaska and Colorado (Hong 1980; Weber and Wittmann 2002, 2007). “Peaty and sandy moist soil in tundra and alpine communities; 0–3800 m; Greenland; N.W.T., Ont.; Alaska, Colo., Maine, N.H.; Europe (Iceland, Norway, Finland, n Russia, Svalbard, Sweden); Asia (n Russia)” (FNA *in prep.*, provisional publication).

Scapania irrigua (Nees) Nees

First record: 2008. Frequent; on open and shrubby banks of creeks in forests, on rocks in streams, in cliff crevices and in springy fens, near snow-melt streamlets, on decaying wet logs and moist peaty, sandy and gravelly soil, from montane through the alpine.

Muddy Creek: Lily Lake Fen, 2008, 7700 ft, 3038.

Beartooth Butte: boggy shore of Island Lake, 2008, 9500 ft, 2378; Little Bear Creek-1, 2008, 9700 ft, 2694 (MO, VBGI), det. V. Bakalin; Little Bear Lake Fen, 2008, 9600 ft, 2743, gemm.; Beartooth Lake CG: wet subalpine meadow, 2009, 8900 ft, 4911. **Deep Lake:** inlet of Frozen Lake, 2008, 10,500 ft, 2551; unnamed alpine lake S of Hwy 212, 2008, 10,000 ft, 2677 (CAS, MO, VBGI), det. V. Bakalin; Wyoming Creek-1, 2008, 10,300 ft, 3465; summits: small alpine lake, 2008, 10,500 ft, 3513 (MO, VBGI), det. V. Bakalin.

Black Pyramid Mountain: summits: alpine fen-3, 2008, 10,100 ft, 2522, gemm.

Scapania mucronata H.Buch

First record: 2009. Rare, single collection from montane elevation.

Muddy Creek: Lake Creek Waterfalls, on granite ledges, in shade, 2009, 7500 ft, 5851 (MO, VBGI), det. V. Bakalin.

* **Scapania paludicola** Loeske & Müll.Frib.

First record: 2008. Sporadic; on moist soil in meadows and fens along lakes, in crevices of wet cliffs, in subalpine and alpine zones.

Beartooth Butte: boggy shore of Island Lake, 2008, 9500 ft, 2373 (MO, VBGI), det. V. Bakalin; Beartooth Lake CG: wet subalpine meadow, 2009, 8900 ft, 4911 (MO, VBGI), det. V. Bakalin. **Deep Lake:** Littlerock Creek Fen, 2008, ! 10,650 ft (3250 m), 3644.

Note: Altitudinal update – 3250 m vs. “0–2000 m” (FNA *in prep.*, provisional publication).

* ** **Scapania scandica** (Arnell & H.Buch) Macvicar First record: 2010. Rare, single collection from subalpine zone.

Beartooth Butte: Clay Butte Fen, on soil over rock, 2010, ! 9000 ft (2740 m), 8264 (MO, VBGI), det. V. Bakalin.

Note: A subarctic-montane species. In Hong (1980): distribution in western North America – Alaska,

Northwest Territories. “Mostly neutral to acid mineral, humic and peaty soils slightly covered by bryophytes; 0–1500 m; Greenland; B.C., Nfld., N.W.T., N.S., Ont., Que.; Alaska, Maine, Mass., N.Y., Wash., Wis.; Eurasia; Atlantic Islands” (FNA *in prep.*, provisional publication). Wyoming is the southernmost station where the species is rare (Kosovich-Anderson unpublished data). Altitudinal update – 2740 m.

Scapania subalpina (Nees ex Lindenb.) Dumort.

First record: 2008. Frequent; in subalpine fens, beside streams and on rocks in drying stream bed in alpine zone, on moist soil over rocks and rotten wood in wet montane and subalpine coniferous forests; subarctic-subalpine species/montane, subalpine, alpine.

Muddy Creek: Lake Creek CG: wet spruce forest, 2009, 6950 ft, 5900 (MO, VBGI), det. V. Bakalin.

Beartooth Butte: Little Bear Creek-1, 2008, 9700 ft, 2684; Little Bear Lake Fen, 2008, 9600 ft, 2786; Little Bear Creek-3, 2009, 9400 ft, 5338; Fantan Lake: N shore, 2010, 9500 ft, 7033 (MO, VBGI), det. V. Bakalin. **Deep Lake:** unnamed alpine lake S of Hwy 212, 2008, 10,000 ft, 2655 (MO, VBGI), det. V. Bakalin; Sawtooth Lake, 2009, 9200 ft, 6037 (MO, VBGI), ver. V. Bakalin; tributary of Canyon Creek-2, 2010, 9400 ft, 7779.

Scapania undulata (L.) Dumort.

First record: 1953. Frequent; on rocks adjacent to streams and springs, in crevices of cliffs, at subalpine elevations.

Beartooth Butte: N of Beartooth Lake, 1953, 9000 ft, *Lawton 1984* (WTU); Beartooth Creek (Hong 1977); boggy shore of Island Lake, 2008, 9500 ft, 2387; Beauty Lake Trail, 2009, 8900 ft, 5226 (MO, VBGI), det. V. Bakalin; Fantan Lake: N shore, 2010, 9500 ft, 7015. **Deep Lake:** Canyon Creek, 2009, 9400 ft, 5667.

Schistochilopsis incisa (Schr.) Konstant.

[*Lophozia incisa* (Schr.) Dumort.]

First record: 2008. Sporadic; epixylic species, on shaded decaying logs, trunks and duff, in wet montane and subalpine forests and meadows, mainly in streamsides.

Muddy Creek: Lily Lake Swamp Forest, 2008, 7700 ft, 3031 (MO, VBGI), det. V. Bakalin; tributary of Beartooth Creek-1, 2010, 8400 ft, 7091; Lake Creek-1, 2010, 7700 ft, 7157. **Deep Lake:** Top Lake, N slope: subalpine meadow, 2010, 9500 ft, 7749.

* **Schljakovia kunzeana** (Huebener) Konstant.

[*Orthocaulis kunzeanus* (Huebener) H.Buch, *Barbilophozia kunzeana* (Huebener) Müll.Frib.]

First record: 2008. Frequent; on wet boggy soil over rocks in fens, wet meadows and along streams, on peaty ledges, at subalpine and alpine elevations; arctic-alpine to arcto-boreal-montane.

Beartooth Butte: Little Bear Lake Fen, 2008, 9600 ft, 2833 (CAS, MO, VBGI); Beartooth Lake CG, wet subalpine meadow, 2009, 8950 ft, 4904 (MO, VBGI). **Deep Lake:** Littlerock Creek Fen, 2008, ! 10,650 ft

(3250 m), 3588 (MO, VBGI); Top Lake Fen-1, 2009, 9450 ft, 5777 (MO, VBGI) & 2010, 9450 ft, 7741 (MO, VBGI); Sawtooth Lake, 2009, 9250 ft, 6020 (MO, VBGI); head of unnamed creek-1, 2010, 10,250 ft, 6751 (MO, VBGI). All det. V. Bakalin.

Note: Altitudinal update – 3250 m vs. “0–1500 m” (FNA *in prep.*, provisional publication).

* **Solenostoma obovatum** (Nees) C.Massal.

[*Jungermannia obovata* Nees, *Plectocolea obovata* (Nees) Mitt., *P. subelliptica* (Lindb. ex Heeg) A.Evans)]

First record: 2009. Rare, two collections from Morrison Jeep Trail area in subalpine zone; arctic-alpine (or arctic-montane) species.

Deep Lake: Canyon Creek, on shaded wet rocks lining the creek, assoc.: *Cephalozia bicuspidata*, 2009, 9400 ft, 5655 (MO, VBGI); Top Lake Fen-2, on soil over granite rocks amongst the fen, 2010, ! 9450 ft (2880 m), 7737 (MO, VBGI). All det. V. Bakalin.

Note: Altitudinal update – 2880 m vs. “0–2000 m” (FNA *in prep.*, provisional publication).

* **Tritomaria exsectiformis** (Breidl.) Schiffn. ex Loeske

First record: 1977. Rare, single collection from montane zone.

Muddy Creek: Lake Creek (Hong 1977).

MUSCI

Abietinella abietina (Hedw.) M.Fleisch.

First record: 2008. Frequent; in loose mats on loamy soil, on soil over rock outcrops, on the sides of grass tussocks in tundra and alpine and subalpine meadows.

Beartooth Butte: creek connecting Fort and Chain Lakes, 2010, 9500 ft, 7788. **Deep Lake:** summits: alpine fen-1, 2008, 10,500 ft, 2301; summits: alpine tundra-3, 2008, 10,350 ft, 2399; summits: alpine tundra-6, 2008, ! 10,850 ft (3310 m), 3339; Gravel Pit vicinity, alpine tundra, 2010, 10,400 ft, 7325; Canyon Creek valley: subalpine meadow, 2010, 9400 ft, 7773; summits: alpine tundra-9, 2010, 10,400 ft, 8119.

Black Pyramid Mountain: summits: alpine tundra-1, 2008, 10,200–10,300 ft, 2271; summits: alpine tundra-4, 2008, 10,300 ft, 2484.

Note: Altitudinal update – 3310 m vs. “low to moderate elevations [0–1599 m]” (FNA 2014, p. 375).

** **Amblyodon dealbatus** (Hedw.) P.Beauv.

First record: 1953. Rare; at subalpine elevations.

Beartooth Butte: S slope of Beartooth Butte, 1953, *Lawton 2057* (WTU). **Deep Lake:** Sawtooth Palsa Fen, wet calcareous substrate, 2009, 9700 ft, 5729.

Note: A rare boreal-montane species with disjunctive range, scattered distribution across the temperate part of Northern Hemisphere; characteristically found in calcareous fens and meadows (FNA 2014); sporadically occurs on rotting wood and organic soil in rich fens scattered across the boreal zone, also on wet gravelly substrates covered with

humus along streamsides. Known in Wyoming only from several occurrences in Carbon and Park counties (Porter 1937, Eckel 1996, Kosovich-Anderson unpublished data). Species of conservation concern in Montana (Elliott and Pipp 2019).

Amblystegium serpens (Hedw.) Schimp.

First record: 1953. Common; on tree trunks, rotten wood, exposed roots of trees in forests, on stem bases of willows in riparian willow communities and willow carrs, on rocks, clayey and boggy soil in fens, on wet tundra soil, from foothills through the alpine.

Muddy Creek: Mud Lake Fen, 2008, 7700 ft, 3132; Lewis and Clark Trail: swampy mixed forest, 2009, 6600 ft, 6196, S+; Hwy 212 and Rd 188 intersection: boggy valley, 2010, 7550 ft, 7208; Muddy Creek-2, 2010, 7700 ft, 7248; Beartooth Creek-3, 2010, 7550 ft, 7414; tributary of Gilbert Creek, 2010, 7800 ft, 7578; “Beaver Lake”, 2010, 7300 ft, 8335, S+; Ghost Creek, 2010, 7900 ft, 8443. **Beartooth Butte:** S slope of Beartooth Butte, 1953, *Lawton* 2065 (WTU); Clay Butte Fen, 2008, 9000 ft, 2983; creek SW of Beartooth Butte, 2008, 9500 ft, 3857, S+. **Deep Lake:** summits: alpine tundra-6, 2008, ! 10,850 ft (3310 m), 3371. **Black Pyramid Mountain:** WY-MT state line: unnamed lake, 2010, 9800 ft, 8073.

Note: Altitudinal update – 3310 m vs. “0–3000 m” (FNA 2014, p. 301).

Amphidium lapponicum (Hedw.) Schimp.

First record: 2010. Rare, single collection from upper foothills.

Jim Smith Peak: Crazy Creek-2, on shaded granite cliffs lining the creek, 2010, 6850 ft, 7956.

* ** **Anomobryum julaceum** (Schrad. ex P.Gaertn., B.Mey. & Scherb.) Schimp.

[*Bryum julaceum* Schrad. ex P.Gaertn., B.Mey. & Scherb.]

First record: 2009. Rare, single collection from montane zone.

Muddy Creek: Lake Creek Waterfalls, on a layer of soil over granite rock, in splash zone of the waterfall, 2009, 7500 ft, 5847 (DUKE), ver. J. Shaw.

Note: A regionally rare montane species, usually occurring on slightly acidic rocks; known from a single station in Wyoming – on the Beartooth Plateau (Kosovich-Anderson unpublished data).

Aulacomnium palustre (Hedw.) Schwägr.

First record: 1953. Common; on moist soil in riparian wetlands, meadows, and fens, willow carrs, on boggy shores of lakes and ponds, in swampy forests, from foothills through the alpine.

Jim Smith Peak: bog between Reed Lake and Rock Creek, 2007, 7500–7800 ft, *E.Elliott* (with *B. Elliott & Heidel*) 3846 (RM), det. YKA; Little Moose Peatlands, 2002, 7960 ft, *Jackson s.n.* (RM), det. J. Harpel; Rock Creek Fen and Little Moose Lake Fen (Heidel et al. 2008); Crazy Creek CG Swamp, 2008, 7000 ft, 3167. **Muddy Creek:** East Lily Peatland, 2002, 8100 ft, *Jackson s.n.* (RM), det. J. Harpel; Ghost Creek Fen and Lily Lake East Fen (Heidel et

al. 2008); Lily Lake Swamp Forest, 2008, 7700 ft, 3019, S+; Lewis and Clark Trail: swampy mixed forest, 2009, 6600 ft, 6195. **Beartooth Butte:** NW side of Beartooth Lake, 1953, *Lawton* 2072 (WTU); Clay Butte Fen, Fantan North Fen, Lower Sheepherder Fen, and Meadow Lake Fen (Heidel et al. 2008). **Deep Lake:** S of Sawtooth Mt., palsa peatbeds, 2007, 9670–9800 ft, *E.Elliott* 3566 (RM), det. YKA, S+; Wyoming Creek and upstream, streamside, 2008, 10,000–10,170 ft, *Hartman* 87880 (RM), det. YKA; Lake WGN Fen, Littlerock Creek Fen, and Sawtooth Palsa Fen (Heidel et al. 2008); summits: alpine fen-1, 2008, 10,500 ft, 2321 (CAS, COLO, MO), “*imbricatum*” expression; summits: drying creek in alpine tundra, 2008, 10,350 ft, 2427 (MHA, MO), “*imbricatum*” expression. **Black Pyramid Mountain:** summits: alpine fen-3, 2008, 10,100 ft, 2519, “*imbricatum*” expression; WY-MT state line: unnamed lake, 2010, 9800 ft, 8059, S+. **Unclear location:** Beartooth Pass, 1965, 10,000 ft, *Hermann* 20073 (RM).

* **Barbula convoluta** Hedw.

* - var. **convoluta**

First record: 2008. Rare, two collections from montane and subalpine zones.

Muddy Creek: Lake Creek CG: wet coniferous forest, creek bank, on bare soil, 2009, 6950 ft, 5918.

Beartooth Butte: Little Bear Lake Fen, on wet clay at the roadside, assoc. *Polytrichum juniperinum* Hedw. and *Ceratodon purpureus* (Hedw.) Brid., 2008, 9600 ft, 2855.

* - var. **eustegia** (Cardot & Thér.) R.H.Zander

First record: 2009. Rare, single collection from subalpine zone. E.

Muddy Creek: seepage slope along Hwy 212, sandy bank of ditch, 2009, 8700 ft, 6104, det. P. Eckel.

Bartramia ithyphylla Brid.

First record: 1953. Frequent; on shaded granite cliffs and boulders in upper elevation forest habitats, on wet soil of lake and stream banks, in subalpine and alpine zones; arctic-alpine.

Beartooth Butte: Beartooth Lodge, near stream, 1953, *Lawton* 1931 (WTU); Beartooth Lake, S slope, 1953, 9000 ft, *Whitehouse* 27454a (BRIT); Long Lake: E shore, 2010, 9600 ft, 6808; Fantan Lake: E shore, 2010, 9500 ft, 6879. **Deep Lake:** inlet of Frozen Lake, 2008, 10,500 ft, 2593, S+; Wyoming Creek-2, 2009, 10,600 ft, 5036, S+; Sawtooth Lake, 2009, 9300 ft, 5990; tributary of Canyon Creek-1, 2010, 9900 ft, 6770.

Blindia acuta (Hedw.) Bruch & Schimp.

First record: 1973. Rare, from montane through the alpine.

Muddy Creek: Lake Creek Waterfalls, on wet soil under *Picea engelmannii*, 2009, 7500 ft, 5825 (MO), det. B. Allen. **Deep Lake:** [Hwy 212], W side, under late snow patch on steep slope N of switchback, rills and snowbeds, 1973, ! 3200 m.s.m. (3200 m), *Weber B-44312* (COLO).

Note: Altitudinal update – 3200 m vs. “low to high elevations (0–3000 m)” (FNA 2007, p. 327).

Brachytheciastrum collinum (Schleich. ex Müll.Hal.) Ignatov & Huttunen

[*Brachythecium collinum* (Schleich. ex Müll.Hal.) Schimp.]

First record: 1953. Common; on soil over rocks (especially limestone) or in sheltered areas around boulders in *Artemisia tridentata* shrublands and *Festuca idahoensis* grasslands, in montane and subalpine aspen and coniferous forests; on rocky ridgcrests, stabilized talus and rock outcrops at alpine elevations.

Muddy Creek: Hwy 212 and Hwy 296 intersection: slope facing to S, 2009, 7200 ft, 5889; aspen stands along Hwy 212, 2009, 8300 ft, 6113; Lake Creek-1, 2010, 7700 ft, 7146; Rd 188: sparsely forested slope, 2010, 7600 ft, 7187, S+. **Beartooth Butte:** S slope of Beartooth Butte, 1953, *Lawton 2049* (WTU); Clay Butte Fen, 2008, 9000 ft, 2933; Clay Butte: slope facing to E, 2008, 9700 ft, 3832; Beartooth Butte-1, 2009, 9250 ft, 5259, S+; Beartooth Butte-2, 2010, 9000 ft, 6615; Beartooth Lake CG: coniferous forest-2, 2010, 8950 ft, 8022. **Deep Lake:** summits: Stockade area, 2010, 11,050 ft, 6702; Hwy 212: roadside granite debris, 2010, 10,200 ft, 6728, S+; inlet of Frozen Lake, dry portion of S-facing slope, 2008, 10,500 ft, 2593; Top Lakes: old-growth spruce-fir forest, 2010, 9600 ft, 7688, S+; Gardner Lake: head of USFS Trail, 2010, 10,600 ft, 8187. **Unclear locations:** [Hwy 212], 1953, 10,000 ft, *Whitehouse 27480* (WTU); [Hwy 212], *Picea* forest with *Pinus flexilis* E.James and *P. contorta*, 1973, *Weber B-44220* (COLO, RM).

Brachytheciastrum velutinum (Hedw.) Ignatov & Huttunen

[*Brachythecium velutinum* (Hedw.) Schimp.]

- **var. salicinum** (Schimp.) Ochyra & Żarnowiec

[*Brachythecium suberythrorrhizon* Renauld & Cardot]

First record: 2009. Rare, single collection from montane zone.

Jim Smith Peak: Crazy Creek-1, on soil over granite rock, in shade, 2009, 7000 ft, 5614 (MHA, MO), det. M. Ignatov.

Brachythecium acutum (Mitt.) Sull.

[*Brachythecium pseudocollinum* Kindb.]

First record: 2010. Rare, single collection from montane zone. E.

Muddy Creek: Lake Creek-1, on wet sandy and humus soil in wet *Picea glauca* x *P. engelmannii*/*Vaccinium scoparium* Leiberg ex Coville forest along creek, 2010, ! 7700 ft (2350 m), 7111 (MHA, MO), det. M. Ignatov.

Note: Altitudinal update – 2350 m vs. “low to moderate elevations (0–1000 m)” (FNA 2014, p. 423).

** **Brachythecium brandegeei** (Austin) H.Rob.

[*Cirriphyllum brandegeei* (Austin) Grout]

First record: 2008. Sporadic; on soil at base of rock outcrops in alpine tundra, on clayey, loamy and soaked peaty soil along streams and in fens in late snow-melt areas, on debris of limestone rock; from upper subalpine through the alpine. E.

Muddy Creek: Clay Butte: slope facing to W, 2009, 9800 ft, 4934 (MHA, MO). **Deep Lake:** summits: small alpine lake, 2008, 10,500 ft, 3516 (MHA, MO); inlet of Frozen Lake, 2008, 10,500–10,550 ft, 2626 (CAS, MHA, MO). **Black Pyramid Mountain:** summits: alpine tundra-4, 2008, 10,250–10,300 ft, 2485 (MHA, MO). All det. M. Ignatov.

Note: A rare alpine species, highly localized endemic of North America, known only from Colorado and Wyoming (Kosovich-Anderson and Ignatov 2010).

* **Brachythecium campestre** (Müll.Hal.) Schimp.

First record: 2008. Rare, two collections from montane zone.

Muddy Creek: Ghost Creek Fen, on wet soil and duff, 2008, ! 7900 ft (2400 m), 3755; “Beaver Lake”, *Picea glauca* forest, on thin soil over decaying wood, 2010, 7300 ft, 8327 (MHA, MO), det. M. Ignatov.

Note: The Beartooth station of the species is located on the western border of its North American range. Altitudinal update – 2400 m vs. “low to moderate elevations (10–500 m)” (FNA 2014, p. 419).

Brachythecium cirrosum (Schwägr.) Schimp.

[*Cirriphyllum cirrosum* (Schwägr.) Grout]

First record: 2008. Rare (undercollected?), single collection from alpine zone; arctic-alpine.

Deep Lake: summit: alpine fen-4, on glacial till, shaded by granite outcrop, 2008, 10,400 ft, 3268.

Brachythecium erythrorrhizon Schimp.

- **var. erythrorrhizon**

First record: 1973. Common; on soil over acid and basic rocks, in forested areas, tundra and meadows, along stream banks and lake shores, mainly at subalpine and alpine elevations.

Beartooth Butte: Island Lake CG: spruce forest, 2008, 9500 ft, 2217 (MHA, MO), det. M. Ignatov; Clay Butte: slope facing to E, 2008, 9700 ft, 3839; Beartooth Butte-1, 2009, 8950–9250 ft, 5290 (MHA, MO), det. M. Ignatov; Little Bear Creek-3, 2009, 9400 ft, 5353 (MHA, MO), det. M. Ignatov; Beartooth Falls, 2009, 8900 ft, 5436; Beartooth Lake: W-SW shore, 2010, 8900 ft, 6636. **Deep Lake:** inlet of Frozen Lake, 2008, 10,500 ft, 2645A (MHA, MO), det. M. Ignatov; summits: snow-melt rill, 2010, 10,600 ft, 6723; Gravel Pit vicinity, alpine tundra, 2010, 10,400 ft, 7330; Top Lakes: old-growth spruce-fir forest, 2010, 9600 ft, 7689, S+; Long Lake, NW slope: subalpine meadow, 2010, 9750 ft, 8281 (MHA, MO), det. M. Ignatov. **Unclear location:** [Hwy 212], *Picea* forest with *Pinus flexilis* and *P. contorta*, 1973, *Weber B-44219* (COLO, RM).

** - **var. alpinum** Kosovich-Anderson & Ignatov

First record: 2008. Sporadic; in late snow-melt zone, on wet tussocks in tundra, on wet silt and peaty soil

along subalpine and alpine streams and lakes, in old-growth spruce forest. E.

Beartooth Butte: Island Lake CG: *Picea engelmannii* forest, 2008, 9500 ft, 2217 (MHA, MO). **Deep Lake:** inlet of Frozen Lake, 2008, 10,350–10,550 ft, 2635 (MHA, MO); summits: alpine snow melt area, small lake in vast depression, 2008, 10,500 ft, 3514 (MHA, MO). All det. M. Ignatov.

Note: A rare alpine taxon, highly localized endemic of North America, known only from Colorado and Wyoming. Recently described variety, type specimen is from Wyoming's Beartooth Plateau (Kosovich-Anderson and Ignatov 2010).

Brachythecium frigidum (Müll.Hal.) Besch.

First record: 1953. Rare, in montane zone.

Muddy Creek: Ghost Creek Fen, on soaked clayey soil along streamlet, 2008, 7900 ft, 3745. **Beartooth Butte:** Beartooth Lodge, near stream, 1953, *Lawton 1925* (WTU).

Brachythecium laetum (Brid.) Schimp.

[*Brachythecium digastrum* Müll.Hal. & Kindb.]

First record: 2008. Rare, in montane zone.

Muddy Creek: Ghost Creek Fen, edge, on wet humus soil, 2008, ! 7900 ft (2400 m), 3745; Rd 188: *Pinus contorta* var. *latifolia* (+ *Picea glauca* + *Pseudotsuga menziesii* + *Populus tremuloides*) forest in deep valley, on soil over rock, 2010, 7600 ft, 7180.

Note: Altitudinal update – 2400 m vs. “low to high elevations (0–2300 m)” (FNA 2014, p. 422).

Brachythecium rivulare Schimp.

First record: 1965. Sporadic; in moss-lined forest seeps, sedge swamps, on wet rocks and logs, alluvial sand, gravelly and rocky banks along streams, in temporary flooding depressions, from montane through the alpine.

Muddy Creek: Beartooth Creek-3, 2010, 7550 ft, 7421; Ghost Creek, 2010, 7900 ft, 8426. **Beartooth Butte:** Beartooth Falls, 2009, 8900 ft, 5463; Beartooth Lake: W-SW shore, 2010, 8900 ft, 6578. **Deep Lake:** streamlet through tundra below Beartooth Pass, 38 miles NW of Cody, 1965, 10,000 ft, *Hermann 20075* (RM).

* **Brachythecium salebrosum** (Hoffm. ex F.Weber & D.Mohr) Schimp.

First record: 1973. Frequent; on soil, rocks, tree bases, rotten logs, in exposed to quite shady habitats, from foothills through the alpine.

Muddy Creek: Rd 801: swampy mixed forest, 2009, 7000 ft, 6160; Lake Creek-1, 2010, 7700 ft, 7126; outlet of Lily Lake, 2010, 7700 ft, 7493 (MHA, MO), det. M. Ignatov; Gilbert Creek-2, 2010, 6900 ft, 8020 (CAS, MHA, MO), det. M. Ignatov; “Beaver Lake”, 2010, 7300 ft, 8326 (MHA, MO), det. M. Ignatov; Lake Creek-2, 2010, 6900 ft, 8416 (MHA, MO), det. M. Ignatov. **Beartooth Butte:** Clay Butte Fen, 2008, 9000 ft, 2940; Beartooth Lake CG: coniferous forest, 2010, 8950 ft, 8263 (MHA, MO), det. M. Ignatov. **Deep Lake:** [Hwy 212], W side, under late snow

patch, 1973, ! 3200 m.s.m. (3200 m), *Weber B-44307* (COLO, RM, US).

Note: Altitudinal update – 3200 m vs. “low to moderate elevations (0–1500 m)” (FNA 2014, p. 426).

Brachythecium turgidum (Hartm.) Kindb.

First record: 1953. Sporadic; on wet soil along creek in montane zone, in exposed wet habitats in moist tundra, rills and snowbeds, from upper foothills through the alpine; arctic-alpine.

Jim Smith Peak: W of Beartooth Butte, Crazy Creek CG, 1953, *Lawton 2023* (WTU); Crazy Creek-2, 2010, 6900 ft, 7964. **Deep Lake:** [Hwy 212], W side, under late snow patch, 1973, 3200 m.s.m., *Weber B-44306* (COLO, RM).

* ** **Brachythecium udum** I.Hagen

[*Brachythecium mildeanum* var. *udum* (I.Hagen) Mönk., *B. salebrosum* subsp. *udum* (I.Hagen) J.J.A-mann]

First record: 2008. Rare, in alpine zone; arctic-alpine.

Deep Lake: summits: *Salix* sp./Bryidae fen, bank of alpine pool, on peaty soil, assoc.: *Barbilophozia hatcheri*, *Climacium dendroides* (Hedw.) F.Weber & D.Mohr, *Plagiomnium ellipticum* (Brid.) T.J.Kop., *Polytrichastrum alpinum* (Hedw.) G.L.Sm., and *Sanionia nivalis* Hedenäs, 2008, ! 10,400 ft (3170 m), 3270 (MHA, MO). **Black Pyramid Mountain:** summits: drying creek in alpine tundra, on silt over rock, 2008, 10,100 ft, 2493 (MHA, MO). All det. M. Ignatov.

Note: A rare species of arctic and alpine habitats, with poorly known distribution in North America (so far it has been reported only from Alaska and Yukon). Specimens from the Beartooth Plateau are represented by not a typical form, genetic analysis is needed. Altitudinal update – 3170 m vs. “low elevations (100 m)” (FNA 2014, p. 427).

Bryoerythrophyllum recurvirostrum (Hedw.) P.C.Chen

First record: 1953. Frequent; on soil and rocks (especially limestone) in forested and boggy areas, meadows, stream banks, lake shores, from montane through the subalpine.

Muddy Creek: W of Beartooth Butte, Lake Creek at [Hwy 296], 1953, *Lawton 2093 & 2101* (WTU); Rd 801: swampy mixed forest, 2009, 7000 ft, 6162; Hwy 212 and Rd 188 intersection: boggy valley, 2010, 7550 ft, 7208, S+. **Beartooth Butte:** boggy shore of Island Lake, 2008, 9500 ft, 2372; Clay Butte Fen, 2008, 9000 ft, 2934, S+; Beartooth Lake CG: coniferous forest, 2010, 8950 ft, 8021, S+.

Note: In several collections from subalpine elevations leaves are without apiculus.

Bryum argenteum Hedw.

- var. **argenteum**

First record: 2008. Common; in various habitats – in crevices of limestone, sandstone and granite debris and outcrops, on humus soil and decaying wood in forests, on loamy soil in *Artemisia tridentata* shrub-

lands and *Festuca idahoensis* grasslands; on disturbed substrates: near animals' burrows, dens and nests, on animal trails, on decaying excrements and corpses of animals, in different anthropogenic habitats: along highways, on hard-packed soil along trails, at fireplaces in campgrounds; from foothills through the alpine.

Muddy Creek: Clay Butte: slope facing to W, 2009, 9550–9800 ft, 4919; Lake Creek Waterfalls, 2009, 7500 ft, 5872; Rd 801: swampy mixed forest, 2009, 6800–7000 ft, 6168; SE slope: sagebrush thickets, 2010, 7700 ft, 7405. **Beartooth Butte:** pine forest along Hwy 212, 2008, 8950 ft, 3899; Beartooth Butte-1, 2009, 9250 ft, 5269. **Deep Lake:** Wyoming Creek-1, 2008, 10,300 ft, 3469.1, S+; Sawtooth Lake, 2009, 9300 ft, 5957 (ASC), det. J. Spence; summits: Stockade area, alpine tundra, 2010, 11,050 ft, 6705; summits: alpine tundra-11, 2010, 10,750 ft, 8156. **Black Pyramid Mountain:** summits: alpine tundra-4, 2008, 10,250–10,300 ft, 2468 (ASC), det. J. Spence, S+.

* - **var. muticum** Brid.

First record: 2008. Rare, single collection from subalpine zone.

Beartooth Butte: Clay Butte, slope facing to E, on calcareous soil, 2008, 9550–9700 ft, 3843, det. J. Spence.

Note: “Variety *muticum* is widespread in extreme environments, but the world distribution is not well known” (FNA 2014, p. 127).

* **Bucklandiella sudetica** (Funck) Bedn.-Ochyra & Ochyra

[*Racomitrium heterostichum* (Hedw.) Brid. var. *sudeticum* (Funck) Dixon ex E.Bauer]

First record: 1973. Rare, single collection from subalpine zone.

Beartooth Butte: [Hwy 212], swales around small lakes, subalpine zone between Long Lake and lower Sheepherder Lakes, over irrigated rocks, small cascades between lakes, 1973, 2900 m.s.m., *Weber B-44279* (COLO, WTU).

* **Calliergon cordifolium** (Hedw.) Kindb.

First record: 1973. Frequent; on soaked and boggy soil in swamp coniferous and mixed forests, wet meadows and graminoid fens, willow wetlands along streams and lakes, over irrigated rocks, in subalpine zone.

Beartooth Butte: subalpine zone between Long Lake and lower Sheepherder Lakes, 1973, 2900 m.s.m., *Weber B-44279* (COLO, WTU); Beartooth Falls, 2009, 8900 ft, 5468; Beartooth Lake: W-SW shore, 2010, 8900 ft, 6634; boggy valley NE of Fantan Lake, 2010, 9500 ft, 6830; unnamed creek/“Dichelyma Creek-2”, 2010, 9550 ft, 6968. **Deep Lake:** Canyon Creek, 2009, 9400 ft, 5671.

Calliergon giganteum (Schimp.) Kindb.

First record: 2007. Frequent; submerged in swales of fens, pools, in open habitats of bogs and fens, on boggy shores of lakes, on rocks along streams, on

floating bogs, wet sedge meadows, from montane through the subalpine.

Muddy Creek: bog ca. 1 air mi W of Lily Lake, 2007, 7680–7760 ft, *E.Elliott & B.Elliott 574* (RM), det. YKA; Mud Lake Fen, 2008, 7700 ft, 3107; Gilbert Creek-1, 2010, 7700 ft, 7582. **Beartooth Butte:** Clay Butte Fen (Heidel et al. 2008); Beartooth Lake: E shore, 2009, 8900 ft, 4854; Beartooth Lake CG: wet subalpine meadow, 2009, 8950 ft, 4857. **Deep Lake:** creek connecting Lower Top and Sawtooth Lakes, 2010, 9450 ft, 7630.

** **Calliergon richardsonii** (Mitt.) Kindb. ex G.Roth
First record: 2008. Rare, single collection from subalpine zone; arctic and subarctic to arctic-alpine. **Beartooth Butte:** Little Bear Lake Fen, SE edge, in low hummocks on boggy soil, assoc.: *Hypnum pratense* W.D.J.Koch ex Spruce, 2008, 9600 ft, 2887 (MO), det. B. Allen.

Note: Predominantly arctic and subarctic species rarely found in boreal zone and in mountains southward. Known from few stations in Wyoming, all in high mountains: Medicine Bow Mtns., Bighorn Mtns., and Beartooth Plateau (M. Lenz, personal communication, Kosovich-Anderson 2018). Species of conservation concern in Montana (Elliott and Pipp 2019).

Calliergonella cuspidata (Hedw.) Loeske

First record: 2010. Rare, single collection from subalpine zone.

Beartooth Butte: Beartooth Lake: W shore, on wet sandy soil over rock outcrops along stream, assoc.: *Cratoneuron filicinum* (Hedw.) Spruce, 2010, 8900 ft, 6575.

Campyliadelphus chrysophyllus (Brid.) Kanda

[*Campylium chrysophyllum* (Brid.) Lange]

First record: 2008. Frequent; on rocks and soil, often temporarily wet, vertical walls of ditches in fens and willow wetlands, on soaked peaty soil along pools and lakes, from montane through the subalpine.

Muddy Creek: Lily Lake Fen, 2008, 7700 ft, 3053; Ghost Creek Fen, ecotone zone with spruce forest, 2008, 7900 ft, 3756; Beartooth Creek-3, 2010, 7550 ft, 7420. **Beartooth Butte:** Beartooth Lake: W-SW shore, 2010, 8900 ft, 6592; Fantan Lake: N shore, 2010, 9500 ft, 7018. **Deep Lake:** Long Lake, NW slope: willow wetlands, 2010, 9750 ft, 8291. **Black Pyramid Mountain:** WY-MT state line: unnamed lake, 2010, 9800 ft, 8075.

Campylium protensum (Brid.) Kindb.

[*Campylium stellatum* var. *protensum* (Brid.) Bryhn]

First record: 2008. Sporadic; on mineral-rich wet soil, in swampy forests, boggy lake shores and fens, from subalpine through the alpine; boreal to arctic-alpine. **Beartooth Butte:** Beartooth Lake: W-SW shore, 2010, 8900 ft, 6579. **Deep Lake:** summits: alpine fen-1, 2008, 10,500 ft, 2308; Sawtooth Lake, 2009, 9200 ft, 5993.

Campylium stellatum (Hedw.) Lange & C.E.O.Jensen

First record: 1953. Common; on boggy soil in mineral-rich fens, decaying stumps in swampy forests, along the shores of subalpine lakes, creek banks and montane *Nuphar* sp. pools, rills and snowbeds in alpine tundra, from montane through the alpine.

Muddy Creek: Mud Lake Fen, 2008, 7700 ft, 3104.

Beartooth Butte: up the Beartooth Butte, 1953, *Welch 16770* (WTU); Little Bear Creek-1, 2008, 9700 ft, 2701; Little Bear Lake Fen, 2008, 9600 ft, 2791; Clay Butte Fen, 2008, 8950 ft, 2995; Meadow Lake Fen, 2008, 9850 ft, 3761; Beartooth Falls, 2009, 8900 ft, 5437; Long Lake: E shore, 2010, 9600 ft, 6814; Chain Lake: S shore, 2010, 9500 ft, 7001. **Deep Lake:** [Hwy 212], W side, under late snow patch, 1973, 3200 m.s.m., *Weber B-44345* (COLO, RM); summits: alpine fen-4, 2008, 10,400 ft, 3277; Sawtooth Lake, 2009, 9300 ft, 6004; inlet of Sawtooth Lake, 2009, 9400 ft, 6064.

* **Campylophyllum hispidulum** (Brid.) Hedenäs

First record: 2010. Rare, two collections from upper foothills zone.

Jim Smith Peak: Crazy Creek-2, in crevice of wet granite cliff, in deep shade, assoc.: *Schistidium agassizii* Sull. & Lesq., 2010, 6850–6900 ft, 7951.

Muddy Creek: Gilbert Creek-2, on loamy soil on ledge of granite boulder, 2010, ! 6900 ft (2100 m), 8012.

Note: Altitudinal update – 2100 m vs. “low to high elevations (0–1700 m)” (FNA 2014, p. 316).

* ** **Campylopus schimperi** Milde

First record: 2008. Rare, single collection from upper subalpine zone; arctic-alpine.

Beartooth Butte: Little Bear Lake Fen, aapamire, *Carex scopulorum*/*Sphagnum warnstorffii* + *Aulacomnium palustre*, in pure mats on saturated boggy soil at base of low moss hummock around swale, 2008, 9600 ft, 2896 (BONN, COLO, MO), ver. J.-P. Frahm.

Note: A rare species, global conservation rank G3. Occurs in mountain systems of the Northern Hemisphere at elevations from 2700–3400 m. On the Beartooth Plateau is the only known station of the species in Wyoming (Kosovich-Anderson unpublished data). Periodic reconstruction of Hwy 212, which crosses Little Bear Lake Fen, is negatively affecting the fen ecosystem. The condition of the *C. schimperi* population may be characterized as vulnerable (Kosovich-Anderson 2011b).

Ceratodon purpureus (Hedw.) Brid.

First record: 2008. Common; on packed, recently disturbed forest, meadow and tundra soils, on wet soil in minerotrophic fens; in campsites, burned areas, sidewalk cracks and on neglected ground; on bare, naturally disturbed, soil of stream banks; in *Geum rossii*-dominated alpine tundra on till, frost boils and solifluction lobes; on disturbed soil near mammals' burrows, dens and birds' nests, along animal trails, on well-decaying excrements and corpses of wild animals. Sporophytes common.

Jim Smith Peak: Ivy Lake: SE edge, 2010, 8100 ft, 7565, S+. **Muddy Creek:** Lily Lake Fen, 2008, 7700 ft, 3087, S+; Lake Creek-1, 2010, 7700 ft, 7118.

Beartooth Butte: Island Lake CG: spruce forest, 2008, 9500 ft, 2220; Little Bear Lake Fen, 2008, 9600 ft, 2855; Clay Butte Fen, 2008, 9000 ft, 2937, S+; Little Bear Creek-2, 2008, 9500 ft, 3239; Meadow Lake Fen, 2008, 9850 ft, 3768; Beartooth Lake: W-SW shore, 2010, 8900 ft, 6646, S+. **Deep Lake:** Littlerock Creek Fen, Sawtooth Palsa Fen (Heidel et al. 2008); summits: alpine fen-2, 2008, 10,800 ft, 2335; summits: granite outcrops in alpine tundra-1, 2008, 10,900 ft, 2531; inlet of Frozen Lake, 2008, 10,550 ft, 2578; summits: wet alpine meadow, 2008, 10,750 ft, 3399, S+; Littlerock Creek Fen, 2008, 10,650 ft, 3572, S+; Wyoming Creek-2, 2009, 10,600 ft, 5011; Sawtooth Palsa Fen, 2009, 9700 ft, 5760; W summit and vicinity, 2010, 11,100 ft, 6695; summits: Stockade area, alpine tundra, 2010, 11,100 ft, 6714, S+. **Black Pyramid Mountain:** summits: alpine tundra-1, 2008, 10,250–10,300 ft, 2279, S+; summits: alpine fen-3, 2008, 10,100 ft, 2513, S+; summits: alpine tundra-4, 2008, 10,300 ft, 2481.

Note: In many specimens variability of costa length within one plant was observed - from percurrent to longly excurrent, that put under question mark the taxonomic value of this character. In addition, based on this study, I find debatable the statement by Vitt (2014, p. 129) that in North American peatlands “*Ceratodon* never occurs in rich fen lawns”.

Climacium americanum Brid.

First record: 1953. Rare, single collection from montane zone.

Jim Smith Peak: W of Beartooth Butte, Crazy Creek CG, 1953, *Lawton 2016* (WTU).

Note: Specimen not seen. Occurrence of this species in Wyoming is questioned (Kosovich-Anderson unpublished data).

Climacium dendroides (Hedw.) F.Weber & D.Mohr

First record: 1953. Common; on soil and duff in wet, moist and swampy forests; on wet clayey, sandy and gravelly substrates in streamsides of forests, fens and willow wetlands, from foothills through the alpine.

Jim Smith Peak: W of Beartooth Butte, Crazy Creek CG, 1953, *Lawton 2025* (WTU); Crazy Creek CG Swamp, 2008, 7000 ft, 3182. **Muddy Creek:** Lily Lake Fen, 2008, 7700 ft, 3080; Ghost Creek Fen, 2008, 7900 ft, 3729; Lake Creek Waterfalls, 2009, 7500 ft, 5857; Muddy Creek-1, 2009, 8100 ft, 6132; outlet of Lily Lake, 2010, 7700 ft, 7505. **Beartooth Butte:** [Hwy 212], subalpine zone between Long Lake and lower Shepherd Lakes, 1973, 2900 m.s.m., *Weber B-44278* (COLO, RM), ver. R. Zander; Fantan North Fen (Heidel et al. 2008); Little Bear Lake Fen, 2008, 9600 ft, 2872; Beauty Lake Trail, 2009, 8900 ft, 5233; Beartooth Falls, 2009, 8900 ft, 5463; Chain Lake: S shore, 2010, 9500 ft, 6997. **Deep Lake:** summits: alpine fen-1, 2008, 10,500 ft, 2298; summits: alpine fen-4, 2008, 10,400 ft, 3284; Littlerock Creek Fen, 2008, 10,650 ft, 3668; Wyoming Creek-2, 2009,

10,600 ft, 4976; Sawtooth Lake, 2009, 9250 ft, 5994; Gravel Pit vicinity, alpine tundra, 2010, 10,400 ft, 7292; Dollar Lake: SW shore, 2010, 9400 ft, 7761. **Black Pyramid Mountain:** WY-MT state line: unnamed lake, 2010, 9750 ft, 8061 (CAS).

Coscinodon calyptratus (Drumm.) C.E.O.Jensen

First record: 1953. Sporadic; on shaded granitic boulders in pine stands and along the shore of subalpine lake; essentially arctic-alpine. E.

Muddy Creek: W of Beartooth Butte, [Hwy 296], at Lake Creek, 1953, *Lawton 2040* (WTU); Gilbert Creek-2, 2010, 6900 ft, 8017, S+. **Black Pyramid Mountain:** WY-MT state line: unnamed lake, 2010, 9800 ft, 8101, S+.

Cratoneuron filicinum (Hedw.) Spruce

First record: 1953. Common; on soil and soil over rocks in streams, in wet sites in coniferous forests, willow carrs, and fens (especially calcareous), from upper foothills through the subalpine.

Muddy Creek: tributary of Beartooth Creek-1, 2010, 8400 ft, 7085; Beartooth Creek-3, 2010, 7550 ft, 7434; tributary of Gilbert Creek, 2010, 7800 ft, 7569; Gilbert Creek-2, 2010, 6900 ft, 8017 (CAS). **Beartooth Butte:** S slope of Beartooth Butte, 1953, *Lawton 2059* (WTU); NW side of Beartooth Lake, 1953, *Lawton 2070* (WTU); Little Bear Creek-2, 2008, 9450 ft, 3235; Creek SW of Beartooth Butte, 2008, 9500 ft, 3856; Beauty Lake Trail, 2009, 8900 ft, 5240; Beartooth Butte-1, 2009, 8950 ft, 5256; Clay Butte foothills, 2009, 9000 ft, 5417; Beartooth Lake: W-SW shore, 2010, 8900 ft, 6579.

* **Cynodontium strumiferum** (Hedw.) Lindb.

First record: 2008. Rare, two collections from upper subalpine and alpine elevations.

Deep Lake: Littlerock Creek Fen, in ditch, on soil over granite rocks, 2008, 10,650 ft, 3620. **Black Pyramid Mountain:** WY-MT state line: unnamed lake, peaty bank of lake, 2010, 9800 ft, 8090.

Dichelyma falcatum (Hedw.) Myrin

First record: 1953. Common; on granite rocks in cold, rocky streams, in wet depressions and on stream banks, from montane through the alpine.

Jim Smith Peak: Ivy Lake, SE edge, 2010, 8100 ft, 7538. **Muddy Creek:** Lake Creek CG: wet spruce forest, 2009, 6950 ft, 5896. **Beartooth Butte:** NW side of Beartooth Lake, 1953, *Lawton 2082* (WTU); [Hwy 212], subalpine zone between Long Lake and lower Shepherd Lakes, 1973, 2900 m.s.m., *Weber B-44282* (COLO, RM, WTU); Little Bear Lake Fen, 2008, 9600 ft, 2880 (COLO); unnamed creek/"Dichelyma Creek-1", 2009, 9500 ft, 6082; Fantan Lake: E shore, 2010, 9500 ft, 6893; unnamed creek/"Dichelyma Creek-2", 2010, 9550 ft, 6968; Long Lake: S edge, 2010, 9650 ft, 8302. **Deep Lake:** creek connecting Dollar and Sawtooth Lakes, 2009, 9400 ft, 5800; Sawtooth Lake, 2009, 9200 ft, 5985; Lower Top Lake Fen, 2010, 9450 ft, 7662; unnamed alpine lake along Hwy 212, 2010, 10,000 ft, 8248.

* **Dichodontium pellucidum** (Hedw.) Schimp.

First record: 2008. Sporadic; on wet sandy and clayey soil over stones along willow-lined creek banks, in snow-melt streams, at montane to subalpine elevations.

Muddy Creek: tributary of Beartooth Creek-1, 2010, 8400 ft, 7097. **Beartooth Butte:** Little Bear Creek-2, 2008, ! 9500 ft (2900 m), 3262; Little Bear Creek-3, 2009, 9400 ft, 5371.

Note: Altitudinal update – 2900 m vs. "low to high elevations (to 2300 m)" (FNA 2007, p. 385).

* **Dicranella heteromalla** (Hedw.) Schimp.

First record: 2008. Rare, single collection from alpine zone.

Deep Lake: Hwy 212, summits: small alpine lake, on shaded silt over rocks along lake shore, 2008, 10,500 ft, 3520.

* **Dicranella palustris** (Dicks.) Crundw. ex E.F.Warb.

First record: 2010. Rare, single collection from montane zone.

Muddy Creek: Gilbert Creek-1, *Carex* spp./Bryidae fen along creek bank, on damp clayey soil in seepage, 2010, ! 7700 ft (2350 m), 7591 (US), det. R. Ireland (Kosovich-Anderson 2011c).

Note: Altitudinal update – 2350 m vs. "low to medium elevations [0–1599 m]" (FNA 2007, p. 388).

Dicranella subulata (Hedw.) Schimp.

First record: 1953. Sporadic, at subalpine and alpine elevations; on damp sandy and loamy soil.

Beartooth Butte: NW side of Beartooth Lake, 1953, *Lawton 2074* (WTU); Little Bear Lake Fen, 2008, 9600 ft, 2799. **Deep Lake:** inlet of Frozen Lake, 2008, ! 10,550 ft (3220 m), 2551.

Note: Altitudinal update – 3220 m vs. "low to medium elevations [0–1599 m]" (FNA 2007, p. 392).

* **Dicranoweisia cirrata** (Hedw.) Lindb. ex Milde

First record: 1953. Frequent; on rocks and decaying trunks and logs in forests and shrublands, from foothills through the subalpine. Gemmae common.

Jim Smith Peak: Beartooth Lodge, near stream, 1953, *Lawton 1950* (WTU); W of Beartooth Butte, Crazy Creek CG, 1953, *Lawton 2033* (WTU); Crazy Creek CG Swamp, 2008, 7000 ft, 3226, S+. **Muddy Creek:** aspen grove along Hwy 212, 2008, 7700 ft, 3927, gemm.; Gilbert Creek-2, 2010, 6900 ft, 8019, gemm. **Beartooth Butte:** Clay Butte foothills, subalpine forest, 2009, ! 9000 ft (2740 m), 5391 (US), det. R. Ireland, gemm.

Note: Altitudinal update – 2740 m vs. "1–1900 m" (FNA 2007, p. 396).

Dicranoweisia crispula (Hedw.) Milde

First record: 1953. Common; on rocky ridgecrests, outcrops, stabilized talus, forming cushions on shaded granite rocks in alpine tundra and forested communities below the tree line; occasionally epixylic or growing on burnt wood, from montane through the alpine; essentially arctic-alpine. Sporophytes common.

Jim Smith Peak: Crazy Creek CG Swamp, 2008, 7000 ft, 3214, S+. **Muddy Creek:** Clay Butte: slope facing to W, 2009, 9800 ft, 4932, S+; aspen stands along Hwy 212, 2009, 8350 ft, 6108, S+; Lake Creek-1, 2010, 7700 ft, 7167 (US), det. R. Ireland; outlet of Lily Lake, 2010, 7700 ft, 7485 (US), det. R. Ireland; “Beaver Lake”, 2010, 7300 ft, 8340, S+. **Beartooth Butte:** Beartooth Lodge, near stream, 1953, *Lawton 1928* (WTU); [Hwy 212], granitic ridges with *Picea* and *Pinus flexilis*, vicinity of Long Lake and lower Shepherd Lake, 1973, 2900 m.s.m., *Weber B-44232* (COLO, RM); Island Lake CG: spruce forest, 2008, 9500 ft, 2222, S+; Beauty Lake Trail, spruce forest, 2009, 8950 ft, 5227; 4WD Rd 149-1A: forested SW slope, 2010, 9650 ft, 7005 (US), det. R. Ireland. **Deep Lake:** Top Lakes: old-growth spruce-fir forest, 2010, 9600 ft, 7690, S+. **Black Pyramid Mountain:** summits: alpine fen-3, 2008, ! 10,100 ft (3080 m), 2511. **Unclear location:** granite bluff along [Hwy 212], 47 miles NW of Cody, 1965, 7500 ft, *Hermann 20050* (RM).

Note: Altitudinal update – 3080 m vs. “10–2000 m” (FNA 2007, p. 396).

Dicranum bonjeanii DeNot.

First record: 2008. Sporadic; on calcareous soil in subalpine fens; essentially arctic-alpine.

Beartooth Butte: boggy shore of Island Lake, 2008, 9500 ft, 2365; Little Bear Lake Fen, 2008, ! 9600 ft (2930 m), 2756; Fantan Lake: E shore, 2010, 9500 ft, 6874 (US), det. R. Ireland.

Note: Altitudinal update – 2930 m vs. “60–1300 m” (FNA 2007, p. 404).

* **Dicranum elongatum** Schleich. ex Schwägr.

First record: 2008. Rare, single collection from alpine zone; arctic-alpine.

Deep Lake: Littlerock Creek Fen, *Salix planifolia*/*Carex scopulorum*/*Dicranum elongatum* community, in compact hummocks on peaty soil, abundant, 2008, 10,650 ft, 3593 (COLO, MO).

Dicranum muehlenbeckii Bruch & Schimp.

First record: 1953. Frequent; sandy soil on cliffs along streams, among rocks in montane forests; rills and snowbeds in subalpine meadows and alpine tundra.

Jim Smith Peak: Ivy Lake: SE edge, 2010, 8100 ft, 7539; Crazy Creek-2, 2010, 6900 ft, 7949 (MO, US).

Beartooth Butte: subalpine zone between Long Lake and lower Shepherd Lake, 1973, 2900 m.s.m., *Weber B-44283* (COLO). **Deep Lake:** [Hwy 212], near summit, 1953, ! 11,000 ft (3360 m), *Lawton 2138* (WTU); W side of Beartooth Pass, under late snow patch, 1973, 3200 m.s.m., *Weber B-44303* (COLO, RM); summits: alpine fen-4, 2008, 10,400 ft, 3288; Littlerock Creek Fen, 2008, 10,650 ft, 3597; Wyoming Creek-2, 2009, 10,600 ft, 5092; Canyon Creek valley: subalpine meadow, 2010, 9450 ft, 7768 (US), det. R. Ireland; summits: alpine tundra-12, 2010, 10,700 ft, 8178 (US), det. R. Ireland.

Note: Altitudinal update – 3350 m vs. “10–3100 m” (FNA 2007, p. 414).

Dicranum scoparium Hedw.

First report: 1953. Frequent; on rotten wood, humus and peaty soil in forested areas, from foothills through the upper subalpine.

Jim Smith Peak: Crazy Creek-2, 2010, 6900 ft, 8001.

Muddy Creek: W of Beartooth Butte, along the Clarks Fork, 1953, 6940 ft, *Lawton 2001* (WTU); Lake Creek-2, 2010, 6900 ft, 8414. **Beartooth Butte:** Little Bear Lake Fen, forested edge of the fen, 2008, 9600 ft, 2841 (CAS, COLO, US), det. R. Ireland; Beauty Lake Trail, 2009, 8950 ft, 5215, S+; Fantan Lake: E shore, 2010, 9500 ft, 6875 (US), det. R. Ireland; Long Lake: S edge, 2010, ! 9650 ft (2940 m), 8311 (US), det. R. Ireland. **Deep Lake:** ? Littlerock Creek Fen (Heidel et al. 2008), report based on doubtful identification.

Note: Altitudinal update – 2940 m vs. “50–2900 m” (FNA 2007, p. 403).

Dicranum spadiceum J.E.Zetterst.

First record: 1973. Frequent; in fens, wet meadows, alpine tundra, on soil in rock fields and on ridges along lake shores, at subalpine and alpine elevations; arctic-alpine.

Beartooth Butte: [Hwy 212], granitic ridges near lower Shepherd Lake, 1973, 2900 m.s.m., *Weber B-44241* (COLO, RM); boggy shore of Island Lake, 2008, 9500 ft, 2383. **Deep Lake:** summits: alpine fen-2, 2008, 10,850 ft, 2330; ski-lift scenic point, alpine tundra, 2008, ! 10,900 ft (3320 m), 2348 (MHA, US); summits: alpine tundra-3, 2008, 10,350 ft, 2394 & 2415 (both in MHA); summits: drying creek in alpine tundra, 2008, 10,350 ft, 2424 (MHA); Littlerock Creek Fen, 2008, 10,650 ft, 3604. **Black Pyramid Mountain:** summits: alpine tundra-1, 2008, 10,250–10,300 ft, 2275 (MHA), det. M. Ignatov.

Note: Altitudinal update – 3320 m vs. “10–2300 m” (FNA 2007, p. 414). Specimens 2348, 2394, 2415, and 2424 were used in phylogenetic studies (Ignatova et al. 2015).

Dicranum tauricum Sapjegin

First record: 2010. Rare, in foothills and montane zones.

Jim Smith Peak: Crazy Creek-2, wet *Picea glauca* + *Pinus contorta* var. *latifolia*/*Alnus incana* (L.) Moench forest, on decaying trunk, 2010, 6900 ft, 8001.1. **Muddy Creek:** Lake Creek-1, wet spruce forest, on decaying log along creek, 2010, ! 7700 ft (2350 m), 7150 (US), det. R. Ireland.

Note: Altitudinal update – 2350 m vs. “150–2200 m” (FNA 2007, p. 418).

* ** **Didymodon asperifolius** (Mitt.) H.A.Crum, Steere & L.E.Anderson

[*Barbula asperifolia* Mitt., *Didymodon rufus* Lorentz] First record: 1973. Frequent; in alpine tundra, on glacial till and calcareous silt (frost boils) at snowbeds; arctic-alpine.

Deep Lake: [Hwy 212], alpine bogs of E summit, head of Wyoming Creek, 1973, 3250 m.s.m., *Weber B-44226* (COLO, RM); W side of Beartooth Pass, under late snow patch, 1973, 3200 m.s.m., *Weber B-44293* (COLO); summits: alpine fen-1; 2008, 10,500 ft, 2317 (MO, US); summits: alpine fen-2, 2008, 10,800 ft, 2330; summits: alpine tundra-3, 2008, 10,350 ft, 2410. **Black Pyramid Mountain:** summits: alpine fen-3, 2008, 10,100 ft, 2499.

Note: A rare species of arctic and alpine habitats. In Colorado, it is “a characteristic species of snow-melt basins in the alpine tundra, occurring in loose mats, loosely attached to sandy gravels in periodically inundated meltwater rills” (Weber and Wittmann 2007, p. 124). In Wyoming, the species is known only from the Beartooth Plateau (Kosovich-Anderson unpublished data).

Didymodon fallax (Hedw.) R.H.Zander

First record: 2008. Rare, at alpine elevations.

Deep Lake: Wyoming Creek-1, on calcareous silt, 2008, 10,300 ft, 3491. **Black Pyramid Mountain:** summits: alpine tundra-4, on silt, 2008, 10,250–10,300 ft, 2465.

Didymodon rigidulus Hedw.

- **var. gracilis** (Hook. & Grev.) R.H.Zander

First record: 2009. Rare, single collection from upper subalpine zone.

Muddy Creek: Clay Butte: slope facing to W, grasslands below Rd 142, limestone debris, on loamy soil in crevice of rock, in shade, 2009, 9800 ft, 4936.

* - **var. icmadophilus** (Schimp. ex Müll.Hal.) R.H.Zander

First record: 2008. Rare, single collection from alpine zone; arctic-alpine.

Deep Lake: summits: alpine tundra-6, on loamy soil, 2008, 10,850 ft (3310 m), 3393, gemm., leaves with fragile flexuous subula.

Note: Altitudinal update – 3310 m vs. “low to high elevations (40–2800 m)” (FNA 2007, p. 545).

Didymodon vinealis (Brid.) R.H.Zander

First record: 2010. Rare, single collection from lower montane zone.

Jim Smith Peak: Crazy Creek-2, on soil over shaded granite rocks lining the creek, 2010, 6900 ft, 7967.

Distichium capillaceum (Hedw.) Bruch & Schimp.

First record: 1953. Common; in high altitude wetlands and seeping cliffs, debris and outcrops from foothills through the alpine. Sporophytes common.

Jim Smith Peak: 15 mi W of Beartooth Lake, 1953, *Conard, s.n.* (WTU). **Muddy Creek:** W of Beartooth Butte, [Hwy 296], at Lake Creek, 1953, *Lawton 2098* (WTU); Lily Lake Fen, 2008, 7700 ft, 3093. **Beartooth Butte:** S slope of Beartooth Butte, 1953, *Lawton 2047* (WTU); near top of Beartooth Butte, in sandstone pocket, 1953, *Welch 16773* (WTU); Clay Butte Fen, 2008, 9000 ft, 2935, S+; Beartooth Falls, 2009, 8900 ft, 5460; Beartooth Butte-2, 2010, 8950 ft,

6609, S+. **Deep Lake:** [Hwy 212], near summit, 1953, 10,900 ft, *Lawton 1978* (WTU); summits: alpine fen-2, 2008, 10,800 ft, 2328; Sawtooth Lake, 2009, 9200 ft, 6030, S+; summits: alpine tundra-9, 2010, 10,400 ft, 8135. **Black Pyramid Mountain:** summits: alpine tundra-4, 2008, 10,300 ft, 2459; WY-MT state line: unnamed lake, 2010, 9750 ft, 8088, S+. **Unclear location:** [Hwy 212], 1953, 10,000 ft, *Whitehouse 27476* (WTU).

Distichium inclinatum (Hedw.) Bruch & Schimp.

First record: 2009. Rare (?), single collection from subalpine zone.

Beartooth Butte: Beartooth Butte-1; scattered limestone debris on slope, on a thick layer of humus over rock, assoc.: *Brachytheciastrum collinum*, 2009, 8950–9250 ft, 5261, S+.

Note: Reliable identification is possible only when sporophytes are present.

Ditrichum flexicaule (Schwägr.) Hampe

First record: 2008. Frequent; forms compact mats or sods in seepage areas over rocks in wet forests, fens, and alpine tundra, also on soaked peaty soil along pools and lakes, from montane through the alpine.

Muddy Creek: Lake Creek CG: wet spruce forest, 2009, 6950 ft, 5934. **Deep Lake:** summits: alpine fen-1, 2008, 10,500 ft, 2292; summits: alpine fen-2, 2008, 10,800 ft, 2327 (COLO); two lakes along Hwy 212, 2008, 10,000 ft, 2665; summits: Overlook Roadside Park, 2008, 10,950 ft, 3532. **Black Pyramid Mountain:** summits: alpine tundra-4, 2008, 10,250–10,300 ft, 2459.

Ditrichum gracile (Mitt.) Kuntze

First record: 2008. Rare, in alpine zone.

Deep Lake: summits: alpine fen-2, on calcareous soil, 2008, 10,800 ft, 2330. **Black Pyramid Mountain:** summits: alpine fen-3, on till, 2008, 10,100 ft, 2520.

Drepanocladus aduncus (Hedw.) Warnst.

First record: 1942. Common; on mineral-rich wetlands, eutrophic fens, ditches, or submerged in pools and lakes, rills and snowbeds, in swampy forests, willow wetlands, from foothills through the alpine.

Jim Smith Peak: Little Moose Lake Fen (Heidel et al. 2008). **Muddy Creek:** Lily Lake East Fen (Heidel et al. 2008); Mud Lake Fen, 2008, 7700 ft, 3120; seepage slope along Hwy 212, 2009, 8700 ft, 6101; Rd 801: swampy mixed forest, 2009, 7050 ft, 6158; Lewis and Clark Trail: swampy mixed forest, 2009, 6600 ft, 6187; Hwy 212 and Rd 188 intersection: boggy valley, 2010, 7550 ft, 7203; Gilbert Creek-1, 2010, 7700 ft, 7585; “Beaver Lake”, 2010, 7250 ft, 8355. **Beartooth Butte:** Clay Butte Fen, 2008, 8950 ft, 2995; Creek SW of Beartooth Butte, 2008, 9500 ft, 3865; Beauty Lake Trail, 2009, 8950 ft, 5247; Beartooth Falls, 2009, 8900 ft, 5451. **Deep Lake:** [Hwy 212], W side, under late snow patch, 1973, 3200 m.s.m., *Weber B-44314* (COLO, RM); Wyoming Creek-2, 2009, 10,600 ft, 4985. **Unclear location** (incorrect either coordinates or elevation in the label): along

[Hwy 212], just across the line in Wyoming, in alpine rivulet, 1942, 9500 ft, *Frye 3164* (CAS, NY, WTU), det. A.J. Grout (!).

Drepanocladus longifolius (Wilson ex Mitt.) Broth. ex Paris

[*Drepanocladus capillifolius* (Warnst.) Warnst.]

First record: 2008. Rare, in montane and subalpine zones.

Muddy Creek: Mud Lake Fen, fully submerged in pool, 2008, 7700 ft, 3115. **Beartooth Butte:** Beartooth Lake: E shore, forms carpets on soaked peaty soil and submerged in swales, assoc.: *Sphagnum platyphyllum*. 2009, 8900 ft, 4846 (COLO).

Drepanocladus polygamus (Schimp.) Hedenäs

[*Campylium polygamum* (Schimp.) Lange & C.E.O.-Jensen]

First record: 2008. Frequent; in riparian willow communities, nutrient-rich wetlands, fens, in ditches, submerged in pools and lakes, in swampy forests, from foothills through the upper subalpine.

Jim Smith Peak: Ivy Lake: SE edge, 2010, 8000 ft, 7539. **Muddy Creek:** Ghost Creek Fen (Heidel et al. 2008); Lily Lake Fen, 2008, 7700 ft, 3057; Mud Lake Fen, 2008, 7700 ft, 3124. **Beartooth Butte:** Clay Butte Fen, 2008, 9000 ft, 2983; Meadow Lake Fen, 2008, 9850 ft, 3823; Beartooth Falls, 2009, 8900 ft, 5436; Beartooth Lake: W-SW shore, 2010, 8900 ft, 6651. **Deep Lake:** Canyon Creek, 2009, 9400 ft, 5674. **Black Pyramid Mountain:** WY-MT state line: unnamed lake, 2010, 9750 ft, 8095 (COLO).

Elodium blandowii (F.Weber & D.Mohr) Eckel

[*Helodium blandowii* (F.Weber & D.Mohr) Warnst.]

First record: 2008. Sporadic; in riparian willow communities, fens, swampy coniferous and mixed forests in montane zone.

Jim Smith Peak: Crazy Creek CG Swamp, 2008, 7000 ft, 3166. **Muddy Creek:** Lily Lake Swamp Forest, 2008, 7700 ft, 3048; Ghost Creek Fen, 2008, 7900 ft, 3756.

Encalypta ciliata Hedw.

First record: 1953. Sporadic; on soil in crevices of granite rocks, from montane through the alpine.

Muddy Creek: W of Beartooth Butte, [Hwy 296], at Lake Creek, 1953, *Lawton 2045* (WTU), S+; Lake Creek-1, 2010, 7700 ft, 7117, S+. **Deep Lake:** Gravel Pit vicinity, alpine tundra, 2010, 10,400 ft, 7315.

Encalypta procera Bruch

First record: 2008. Rare, in subalpine and alpine zones; arctic-alpine.

Beartooth Butte: Island Lake CG: subalpine meadow, in crevice of rock, 2008, 9500 ft, 2917. **Deep Lake:** summits: alpine tundra-3, on calcareous loamy soil, 2008, 10,350 ft, 2393.

Encalypta raptocarpa Schwägr.

First record: 1942. Frequent; on rocky ridgecrests and slopes, stabilized talus, in small tufts in rock crevices, on mineral soil on rock ledges or cliffs, on

bare ground in tundra, from foothills through the alpine; essentially arctic-alpine. Sporophytes common.

Muddy Creek: Lake Creek-2, 2010, 6900 ft, 8404, S+.

Deep Lake: Beartooth Pass, 48 km E of Cooke City, alpine meadow, 1993, 3340 m, *Eversman 93192* (ISC), det. D.G. Horton; summits: granite outcrops in alpine tundra, 2008, 10,900 ft, 2537, S+; summits: alpine tundra-6, 2008, 10,900 ft, 3347, S+; summits: Overlook Roadside Park, alpine tundra, 2008, 10,950 ft, 3538; summits: alpine tundra-11, 2010, 10,750 ft, 8148. **Black Pyramid Mountain:** summits: alpine tundra-4, 10,250–10,300 ft, 2471, S+. **Unclear location:** “E from Cooke along Hwy”, on soil among rocks, 1942, 9500 ft, *Frye s.n.* (WTU), det. D.G. Horton as *Encalypta intermedia* Jur.

Eurhynchiastrum pulchellum (Hedw.) Ignatov & Huttunen

[*Eurhynchium pulchellum* (Hedw.) Jenn.]

First record: 1953. Frequent; in forested areas: on tree trunks, decaying wood, duff, on soil over rocks, always in filtered light, rarely in alpine tundra, from montane through the alpine.

Jim Smith Peak: Crazy Creek CG Swamp, 2008, 6950 ft, 3167. **Muddy Creek:** Lily Lake Swamp Forest, 2008, 7700 ft, 3039; tributary of Beartooth Creek-1, 2010, 8450 ft, 7088; Lake Creek-1, 2010, 7750 ft, 7119; outlet of Lily Lake, 2010, 7700 ft, 7516; Ghost Creek, 2010, 7900 ft, 8441. **Beartooth Butte:** W of Beartooth Butte, along Clarks Fork, 1953, 6940 ft, *Lawton 2014* (WTU); pine forest along Hwy 212, 2008, 9000 ft, 3908. **Black Pyramid Mountain:** summits: alpine tundra-4, 2008, 10,250–10,300 ft, 2460.

Fissidens bryoides Hedw.

First record: 2008. Frequent; on shaded wet soil of stream banks and ditches, in fens and riparian willow communities, from montane through the alpine.

Muddy Creek: Lily Lake Fen, 2008, 7700 ft, 3053; Lake Creek-1, 2010, 7700 ft, 7141; outlet of Lily Lake, 2010, 7700 ft, 7474; Lake Creek-2, 2010, 6900 ft, 8395. **Deep Lake:** summits: alpine tundra-6, 2008, 10,850 ft, 3381. **Black Pyramid Mountain:** WY-MT state line: unnamed lake, 2010, 9750 ft, 8090.

* **Fissidens osmundioides** Hedw.

First record: 1953. Frequent; in riparian willow communities, on moist soil, shaded rocks and wood, peaty banks of ditches, from montane through the alpine.

Jim Smith Peak: W of Beartooth Butte, Crazy Creek CG, 1953, *Lawton 2019* (WTU); Ivy Lake: SE edge, 2010, 8100 ft, 7521. **Muddy Creek:** Lake Creek Waterfalls, 2009, 7500 ft, 5853. **Beartooth Butte:** boggy shore of Island Lake, 2008, 9500 ft, 2385; Long Lake: E shore, 2010, 9600 ft, 6808; Fantan Lake: E shore, 2010, 9500 ft, 6889. **Deep Lake:** Littlerock Creek Fen, 2008, 10,650 ft, 3636; Top Lake Fen-1, 2009, 9450 ft, 5782; Sawtooth Lake, rapids, 2009, 9300 ft, 6040.

Fontinalis antipyretica Hedw.

First record: 1953. Frequent; on submerged granite rocks, logs, roots in slow- or fast-moving streams, in ponds and ditches, at montane and subalpine elevations.

Muddy Creek: Gilbert Creek-1, 2010, 7700 ft, 7589.

Beartooth Butte: Crane Lake, 1953, *Welch 15079* (WTU); SE and E of Beartooth Lake, 1953, *Welch 16057* (WTU); on creek flowing past Beartooth Lodge into Beartooth Lake, 1953, *Welch 15083* (TENN); creek connecting Fort and Chain Lakes, 2010, 9500 ft, 7792. **Deep Lake:** creek connecting Dollar and Sawtooth Lakes, 2009, 9400 ft, 5799.

Fontinalis hypnoides Hartm.

First record: 2009. Rare, single collection from montane zone.

Muddy Creek: Muddy Creek-1, in slow-moving water of creek, on drowned woods and underwater granite boulders, locally abundant, 2009, 8100 ft, 6120.

Fontinalis neomexicana Sull. & Lesq.

First record: 1953. Rare, single collection, elevation unknown. E.

Beartooth Butte: Beauty Lake, an outlet of Beauty Lake into Crane Lake, attached to rock, submerged, 1953, *Welch 15078* (WTU).

Funaria hygrometrica Hedw.

First record: 2008. Sporadic: on disturbed habitats along highways and roads, on campfire sites; cosmopolitan species.

Jim Smith Peak: Crazy Creek CG, 2008, 7000 ft, 3231, S+. **Beartooth Butte:** Beartooth Lake CG, 2009, 8900 ft, 4914A; Little Bear Lake Fen, roadside, 2008, 9600 ft, 2751 (½).

Gemmabryum caespitium (Hedw.) J.R.Spence
[*Bryum caespitium* Hedw.]

First record: 2008. Frequent; in disturbed areas (near dens and burrows of animals, and on trail banks), on various soils in exposed habitats like dry grasslands, most collections from alpine zone, on lower elevations more likely undercollected.

Deep Lake: summits: alpine fen-2, 2008, 10,850 ft, 2338; summits: alpine tundra-3, 2008, 10,350 ft, 2396, S+; Gravel Pit vicinity, alpine tundra, 2010, 10,400 ft, 7257 (ASC), det. J. Spence; summits: alpine tundra-13, 2010, 10,900 ft, 8194 (ASC), det. J. Spence. **Black Pyramid Mountain:** summits: alpine tundra-4, 2008, 10,300 ft, 2468 (ASC), det. J. Spence, S+; summits: alpine fen-3, 2008, 10,100 ft, 2512.

Grimmia alpestris (F.Weber & D.Mohr) Schleich.

First record: 1953. Sporadic; rocky ridgcrests and slopes, stabilized talus, on open and sheltered granite outcrops in different plant communities, at subalpine and alpine elevations.

Beartooth Butte: Beartooth Lodge, near stream, 1953, *Lawton 1935* (WTU); pine forest along Hwy 212, 2008, 9000 ft, 3888, S+; Island Lake CG: subalpine meadow, 2008, 9500 ft, 2916. **Deep Lake:** [Hwy 212], on rock, 1953, 10,000 ft, *Whitehouse*

27478 (WTU); inlet of Frozen Lake, 2008, 10,350–10,500 ft, 2599, S+.

Grimmia anodon Bruch & Schimp.

First record: 1953. Frequent; mainly on calcareous rocks, in different communities, from montane through the alpine; essentially arctic-alpine. Sporophytes common.

Muddy Creek: Clay Butte: slope facing to W, 2009, 9800 ft, 4917, S+; Lake Creek Waterfalls, 2009, 7500 ft, 5805; Hwy 212 and Hwy 296 intersection: slope facing to S, 2009, 7200 ft, 5877, S+. **Beartooth Butte:** S slope of Beartooth Butte, 1953, *Lawton 2052* (WTU), annot. R. Ireland, 1975; Beartooth Butte-1, 2009, 9250 ft, 5267, S+; Little Bear Creek-3, 2009, 9400 ft, 5347, S+; Beartooth Lake CG: spruce forest, 2009, 8930 ft, 6218. **Deep Lake:** inlet of Frozen Lake, 2008, ! 10,550 ft (3220 m), 2599; Sawtooth Lake, 2009, 9300 ft, 6026.

Note: Altitudinal update – 3220 m vs. “low to high elevations (20–2700 m)” (FNA 2007, p. 232).

Grimmia anomala Hampe ex Schimp.

First record: 1953. Rare, single collection, elevation unknown.

Beartooth Butte: Beartooth Lodge, near stream, 1953, *Lawton 1949* (WTU), annot. R. Ireland.

Grimmia donniana Sm.

First record: 1953. Rare, based on two old collections, elevations unknown.

Muddy Creek: 2 mi W of Beartooth Lake, along stream, 1953, *Whitehouse 27478* (NY). **Unclear location:** ca. 11 miles SE of [Hwy 212], 33 miles NW of Cody, 1965, *Hermann 20027* (NY).

Grimmia elatior Bruch ex Bals.-Criv. & DeNot.

First record: 1953. Frequent; on often sloping, irrigated granite rock outcrops, from montane through the alpine.

Muddy Creek: W of Beartooth [Butte], [Hwy 296], at Lake Creek, 1953, *Lawton 2039* (WTU). **Beartooth Butte:** boggy shore of Island Lake, 2008, 9550 ft, 2435.1, S+. **Deep Lake:** [Hwy 212], near the summit, 1953, 10,940 ft, *Lawton 1980* (WTU); [Hwy 212], dry rocky tundra, head of Wyoming Creek, 1973, 3240 m.s.m., *Weber B-44246* (COLO); summits: alpine tundra-3, 2008, 10,350 ft, 2417; summits: Overlook Roadside Park, alpine tundra, 2008, 11,000 ft, 3527.

**** Grimmia incurva** Schwägr.

First record: 2008. Rare, at alpine elevations.

Deep Lake: summits: alpine tundra-5, shaded granite rocks, 2008, ! 10,700 ft (3260 m), 3320, det. M. Ignatov. **Black Pyramid Mountain:** summits: alpine tundra-1, in crevices of granite outcrop, 2008, 10,250–10,300 ft, 2281.

Note: A regionally rare species (Weber and Wittmann 2002, 2007; Elliott and Pipp 2019); in North America with east-west disjunct distribution, uncommon in the continental interior. Altitudinal update – 3260 m vs. “moderate to high elevations (500–2500 m)” (FNA 2007, p. 252).

Grimmia longirostris Hook.

First record: 1953. Frequent; on exposed, dry and wet surfaces of acidic/granite rocks in different plant communities, in splash zone of waterfall, from upper foothills through the alpine.

Jim Smith Peak: W of Beartooth Butte, Crazy Creek CG, 1953, *Lawton 2036* (WTU); Crazy Creek-2, 2010, 6900 ft, 8003. **Muddy Creek:** SW of Beartooth Butte, on [Hwy 296] at Lake Creek, 1953, *Lawton 2095* (WTU); Lake Creek Waterfalls, 2009, 7500 ft, 5807. **Deep Lake:** [Hwy 212], near summit, 1953, ! 10,940 ft (3330 m), *Lawton 1986* (WTU); summits: alpine tundra-6, 2008, 10,870 ft, 3384.

Note: Altitudinal update – 3330 m vs. “low to high elevations (100–3100 m)” (FNA 2007, p. 239).

Grimmia montana Bruch & Schimp.

First record: 2008. Common; on rocky ridgecrests and slopes, stabilized talus, on exposed acidic granite rocks (and occasionally sandstone), at subalpine and alpine elevations.

Beartooth Butte: Island Lake CG, spruce forest, 2008, 9500 ft, 2224, S+; boggy shore of Island Lake, 2008, 9500 ft, 2439.1; 4WD Rd 149-1A: forested SW slope, 2010, 9650 ft, 7008; Fantan Lake: N shore, 2010, 9550 ft, 7039, S+. **Deep Lake:** summits: alpine tundra-3, 2008, 10,350 ft, 2403; summits: alpine tundra-5, 2008, 10,700 ft, 3323, S+; summits: Overlook Roadside Park, alpine tundra, 2008, 11,000 ft, 3526; summits: granite outcrops in alpine tundra-3, 2009, 11,000 ft, 4950; Wyoming Creek-2, 2009, 10,600 ft, 5105; summits: alpine tundra-13, 2010, 10,900 ft, 8196. **Black Pyramid Mountain:** summits: alpine tundra-1, 2008, 10,250–10,300 ft, 2273; summits: alpine fen-3, 2008, 10,100 ft, 2498.

Grimmia ovalis (Hedw.) Lindb.

First record: 1953. Rare, based on two old collections, from montane through the alpine.

Jim Smith Peak: W of Beartooth Butte, Crazy Creek CG, 1953, *Lawton 2036* (WTU). **Deep Lake:** [Hwy 212], near summit, 1953, ! 11,000 ft (3350 m), *Lawton 2141* (WTU).

Note: Altitudinal update – 3350 m vs. “(low to moderate to high elevations (30–) 1000–2500 m)” (FNA 2007, p. 245).

Grimmia plagiopodia Hedw.

First record: 1953. Rare, single collection, elevation unknown.

Beartooth Butte: S slope of Beartooth Butte, 1953, *Lawton 2050* (WTU).

Grimmia pulvinata (Hedw.) Sm.

First record: 1965. Rare, single collection, elevation unknown.

Unclear location: granite outcrop along Rd ca. 11 mi SE of [Hwy 212], 33 mi NW of Cody, 1965, *Hermann 20025* (RM).

Grimmia sessitana DeNot.

First record: 2008. Sporadic; on granite outcrops and debris in alpine tundra.

Deep Lake: summits: alpine tundra-5, 2008, 10,700 ft, 3323, S+; summits: alpine tundra-6, 2008, 10,900 ft, 3388, det. M. Ignatov; summits: massive granite outcrop in alpine tundra, 2008, 10,900 ft, 3494, S+.

Homalothecium aeneum (Mitt.) E. Lawton

First record: 1965. Rare, single collection from montane elevation. E.

Unclear location: along [Hwy 212], 47 mi NW of Cody, 1965, 7500 ft, *Hermann 20051* (NY, WTU), det. H. Hofmann.

Hygroamblystegium varium (Hedw.) Mönk.

- var. **humile** (P. Beauv.) Vanderp. & Hedenäs

First record: 2010. Rare, single collection from upper subalpine elevation.

Black Pyramid Mountain: WY-MT state line: unnamed subalpine lake, in ditch, on clayey soil, 2010, 9750–9800 ft, 8075.

Hygrohypnum bestii (Renauld & Bryhn) Holz.

[*Platyhypnum bestii* (Renauld & Bryhn) Ochyra]

First record: 1953. Sporadic; attached to inundated rocks in subalpine and alpine streams.

Beartooth Butte: NW side of Beartooth Lake, 1953, *Lawton 2079* (WTU); shore of Beartooth Lake, 1953, *Whitehouse & Lawton, s.n.* (WTU); Beauty Lake Trail, 2009, 8950 ft, 5236 (UBC), ver. D. Jamieson; Little Bear Creek-3, 2009, 9400 ft, 5334. **Deep Lake:** [Hwy 212], E of summit, near small glacial lake, 1953, ! 10,500 ft (3200 m), *Lawton 1972* (WTU).

Note: Altitudinal update – 3200 m vs. “moderate to high elevations (1500–3000 m)” (FNA 2014, p. 272).

Hygrohypnum duriusculum (DeNot.) D.W. Jamieson

[*Hygrohypnum dilatatum* (Wilson) Loeske, *Platyhypnum duriusculum* (DeNot.) Ochyra]

First record: 1973. Frequent; on rocks and wet soil over rocks along streams and lake shores, rills and snowbeds, from foothills through the alpine.

Jim Smith Peak: Crazy Creek-2, 2010, 6850 ft, 7941. **Beartooth Butte:** Beartooth Falls, 2009, 8900 ft, 5425 (UBC), det. D. Jamieson; Beartooth Creek-2, 2010, 8900 ft, 6657. **Deep Lake:** W side of Beartooth Pass, under late snow patch, 1973, 3200 m.s.m., *Weber B-44313* (TENN); inlet of Frozen Lake, 2008, 10,350–10,550 ft, 2648; head of unnamed creek-1, 2010, 10,250 ft, 6738; tributary of Canyon Creek-1, 2010, 9900 ft, 6764.

Hygrohypnum luridum (Hedw.) Jenn.

First record: 1953. Sporadic; occurs attached to stones and soil banks of streams, inundated by water, often on calcareous substrates, at subalpine elevations.

Beartooth Butte: Beartooth Lodge, near stream, 1953, *Lawton 1929* (WTU); W end of Beartooth Lake, 1953, *Lawton 1955* (WTU); Beartooth Butte-1, 2009, 9250 ft, 5258 (UBC), det. D. Jamieson; Clay

Butte foothills: subalpine forest, 2009, 9000 ft, 5411; creek SW of Beartooth Butte, 2008, 9500 ft, 3876, S+.

* **Hygrohypnum molle** (Hedw.) Loeske

[*Platyhypnum molle* (Hedw.) Loeske, *Ochyraea mollis* (Hedw.) Ignatov]

First record: 1973. Sporadic; occurs attached to stones and soil banks of streams, inundated by water; rills and snowbeds in alpine tundra, at subalpine and alpine elevations.

Beartooth Butte: Beartooth Falls, 2009, 8900 ft, 5427.

Deep Lake: [Hwy 212], W side, under late snow patch, 1973, 3200 m.s.m., *Weber B-44313* (COLO, RM); inlet of Frozen Lake, 2008, 10,550 ft, 2643; Wyoming Creek-2, 2009, 10,550 ft, 5017; Sawtooth Lake, 2009, 9200 ft, 6009.

Hygrohypnum ochraceum (Turner ex Wilson) Loeske
[*Hygrohypnella ochracea* (Turner ex Wilson) Ignatov & Ignatova]

First record: 1953. Common; on wet rocks in subalpine and alpine streams and rivulets, in riparian willow communities.

Beartooth Butte: Beartooth Lodge, near stream, 1953, *Lawton 1926* (WTU); Little Bear Creek-1, 2008, 9700 ft, 2700; Little Bear Lake Fen, 2008, 9600 ft, 2812, S+; Beartooth Lake: E shore, 2009, 8900 ft, 4836A; Beartooth Lake CG: wet subalpine meadow, 2009, 8950 ft, 4906 (CAS, COLO), S+; Long Lake: E shore, 2010, 9600 ft, 6784; Fantan Lake: N shore, 2010, 9500 ft, 7036; creek connecting Fort and Chain Lakes, 2010, 9500 ft, 7792.

Deep Lake: [Hwy 212], W of the summit, along a stream, 1953, 9000–10,000 ft, *Lawton 1991* (WTU); Sawtooth Palsa Fen (Heidel et al. 2008); inlet of Frozen Lake, 2008, 10,350 ft, 2622; Canyon Creek, 2009, 9400 ft, 5649; Wyoming Creek-1, 2008, 10,300 ft, 3487; inlet of Sawtooth Lake, 2009, 9400 ft, 6070; creek connecting Lower Top and Sawtooth Lakes, 2010, 9450 ft, 7639; Top Lake Fen-2, 2010, 9450 ft, 7730.

* **Hygrohypnum smithii** (Sw.) Broth.

[*Platyhypnum smithii* (Sw.) Ochyra, *Ochyraea smithii* (Sw.) Ignatov & Ignatova]

First record: 2008. Rare, at subalpine and alpine elevations.

Beartooth Butte: Little Bear Creek-3, on wet granite rocks, 2009, 9400 ft, 5381 (UBC), det. D. Jamieson.

Deep Lake: inlet of Frozen Lake, on soil over rocks, 2008, ! 10,550 ft (3220 m), 2650.

Note: Altitudinal update – 3220 m vs. “moderate to high elevations (500–3100 m)” (FNA 2014, p. 280).

** **Hygrohypnum styriacum** (Limpr.) Broth.

First record: 2009. Rare, at subalpine elevations; arctic-alpine or montane.

Beartooth Butte: Beartooth Falls, on wet granite rocks, in splash zone, 2009, 8900 ft, 5431 (UBC), ver. D. Jamieson; Beartooth Lake: W shore, *Picea engelmannii* forest along the shore, on wet clay and sandy soil over rock, 2010, 8900 ft, 6652.

Note: A species of alpine and subalpine habitats, distributed in the mountains of Northern Hemisphere, rare across most of its range. Known from two stations in Wyoming, both on the Beartooth Plateau (Kosovich-Anderson and Weber 2011).

Hylocomium splendens (Hedw.) Schimp.

First record: 2008. Rare; on soil, humus, litter-fall, duff and well-decayed wood in old-growth forests, in montane zone.

Muddy Creek: Lily Lake vicinity, swampy *Picea glauca*/*Alnus* sp./Bryidae forest, 2008, 7750 ft, 3024 (COLO); Lake Creek-2, *Picea* sp. + *Pinus contorta* var. *latifolia* forest, 2010, 6900 ft, 8423.

Hypnum lindbergii Mitt.

[*Calliergonella lindbergii* (Mitt.) Hedenäs]

First record: 2008. Frequent; on wet clayey and sandy soil in willow carrs, meadows, and on lake margins, on logs and decaying wood in swamp forests, on moist soil along snow-melt streamlets in the subalpine.

Jim Smith Peak: Ivy Lake: SE edge, 2010, 8000–8100 ft, 7528. **Muddy Creek:** Gilbert Creek-2, 2010, 6900 ft, 8006. **Beartooth Butte:** boggy shore of Island Lake, 2008, 9500 ft, 2388; Little Bear Creek-1, 2008, 9700 ft, 2683; Beartooth Lake CG: wet subalpine meadow, 2009, 8950 ft, 4868; Beartooth Lake: W shore, 2010, 8900 ft, 6601; Long Lake: S edge, 2010, 9650 ft, 8302. **Deep Lake:** Sawtooth Meadow, 2009, 9400 ft, 5767; Sawtooth Lake, N shore, 2009, 9250 ft, 6029. **Black Pyramid Mountain:** WY-MT state line: unnamed lake, 2010, 9750 ft, 8052.

Hypnum pallescens (Hedw.) P.Beauv.

[*Jochenia pallescens* (Hedw.) Hedenäs, Schlesak & D.Quandt]

First record: 2010. Rare, single collection from montane zone.

Jim Smith Peak: Crazy Creek-2, on bank of a dry streamlet, 2010, ! 6900 ft (2100 m), 7949.

Note: Altitudinal update – 2100 m vs. “low to high elevations (0–2000 m)” (FNA 2014, p. 545).

* **Hypnum pratense** W.D.J.Koch ex Spruce

[*Breidleria pratensis* (W.D.J.Koch ex Spruce) Loeske]

First record: 2008. Frequent; on moist soil in fens and calcareous sites, in willow carrs and wet tundra, from montane through the alpine.

Jim Smith Peak: Crazy Creek CG Swamp, 2008, 6950 ft, 3169. **Muddy Creek:** Lily Lake East Fen (Heidel et al. 2008); Lily Lake Fen, 2008, 7700 ft, 3066; Ghost Creek Fen, 2008, 7900 ft, 3718.

Beartooth Butte: Little Bear Lake Fen, 2008, 9600 ft, 2889; Beartooth Lake: E shore, 2009, 8850 ft, 4856. **Deep Lake:** summits: alpine fen-4, 2008, 10,400 ft, 3271; Littlerock Creek Fen, 2008, ! 10,650 ft (3250 m), 3674; Sawtooth Lake, 2009, 9200 ft, 5970.

Note: Altitudinal update – 3250 m vs. “low to high elevations (0–3000 m)” (FNA 2014, p. 546).

Hypnum revolutum (Mitt.) Lindb.

- var. **revolutum**

[*Roaldia revoluta* (Mitt.) P.E.A.S.Câmara & M.Carvalho-Silva]

First record: 1953. Common; on boulders, outcrops and rock debris in *Festuca idahoensis* grasslands and *Artemisia tridentata* shrublands, on tree bases and decorticated downed wood throughout the forested area, on soil over rocks in alpine tundra.

Jim Smith Peak: Crazy Creek CG Swamp, 2008, 7000 ft, 3225; WY-MT state line: spruce forest, 2009, 7750 ft, 5479. **Muddy Creek:** Ghost Creek Fen, 2008, 7900 ft, 3743; Lake Creek Waterfalls, 2009, 7500 ft, 5859; aspen stands along Hwy 212, 2009, 8300 ft, 6106; Muddy Creek-1, 2009, 8100 ft, 6130; Lewis and Clark Trail: Douglas-fir forest, 2009, 6800 ft, 6183; SE slope: aspen grove, 2010, 7750 ft, 7409; Beartooth Creek-3, 2010, 7550 ft, 7415; outlet of Lily Lake, 2010, 7750 ft, 7484. **Beartooth Butte:** S slope of Beartooth Butte, 1953, *Lawton 2056* (WTU); SW side of Beartooth Lake, 1953, *Lawton 2077* (WTU); Clay Butte Fen, 2008, 8950 ft, 2927; Beartooth Butte-1, 2009, 9250 ft, 5293; granite ridge, W slope: coniferous forest, 2010, 9550 ft, 6941. **Deep Lake:** [Hwy 212], near summit, 1953, 10,950 ft, *Lawton 1975* (WTU); summit, 1953, 11,000 ft, *Welch 16642* (WTU); ski-lift scenic point, alpine tundra, 2008, 10,900 ft, 2347; Wyoming Creek-1, 2008, 10,300 ft, 3479; summits: Overlook Roadside Park, alpine tundra, 2008, 10,950 ft, 3531; Littlerock Creek Fen, 2008, 10,650 ft, 3605; summits: Stockade area, alpine tundra, 2010, 11,100 ft, 6710; Gravel Pit vicinity, alpine tundra, 2010, 10,400 ft, 7328; Gardner Lake: head of USFS Trail, 2010, 10,600 ft, 8183. **Black Pyramid Mountain:** summits: alpine tundra-1, 2008, 10,200–10,300 ft, 2277; summits: alpine fen-3, 2008, 10,100 ft, 2505.

* - **var. ravaudii** (Boulay) Ando

[*Roaldia dolomitica* (Milde) Hedenäs, Schlesak & D.Quandt]

First record: 2008. Sporadic; in boulder fields at alpine elevations, on rocks and loamy soil.

Deep Lake: summits: alpine tundra-3, 2008, 10,350 ft, 2400; dry creek in alpine tundra, 2008, 10,350 ft, 2430. **Black Pyramid Mountain:** summits: alpine tundra-1, 2008, 10,200–10,300 ft, 2270; summits: alpine tundra-4, 2008, 10,300 ft, 2469.

Hypnum vaucheri Lesq.

[*Buckia vaucheri* (Lesq.) D.Rios, M.T.Gallego & J.Guerra]

First record: 2008. Common; on rocky ridgcrests and slopes, outcrops, stabilized talus in alpine tundra, on soil over stones (often limestones), from foothills through the alpine.

Muddy Creek: Lewis and Clark Trail: Douglas-fir forest, 2009, 6800 ft, 6182. **Beartooth Butte:** Clay Butte: slope facing to E, 2008, 9700 ft, 3847; Beartooth Butte-1, 2009, 9250 ft, 5268. **Deep Lake:** summits: alpine fen-1, 2008, 10,500 ft, 2298; summits: alpine fen-2, 2008, 10,800 ft, 2327 (COLO); ski-lift scenic point, alpine tundra, 2008, 10,900 ft, 2347; summits: dry creek in alpine tundra, 2008, 10,350 ft,

2439; summits: alpine tundra-5, 2008, 10,650 ft, 3330 (COLO), det. W. Weber; W summit and vicinity, 2010, 11,050 ft, 6692; summits: Stockade area, alpine tundra, 2010, 11,100 ft, 6704. **Black Pyramid Mountain:** summits: alpine tundra-1, 2008, 10,200–10,300 ft, 2273.

Imbriobryum muehlenbeckii (Bruch & Schimp.) N.Pedersen

[*Bryum muehlenbeckii* Bruch & Schimp.]

First record: 2008. Rare, at subalpine and alpine elevations.

Beartooth Butte: SE shore of Island Lake, ecotone between willow wetlands and subalpine *Picea engelmannii* forest, on wet loamy soil, 2008, 9500 ft, 2371 (ASC, COLO, DUKE), det. J. Spence. **Deep Lake:** inlet of Frozen Lake, on moist soil over rock, 2008, ! 10,500 ft (3200 m), 2544.

Note: Infrequently collected montane species. First report for Wyoming was based on the author's collection from the Beartooth Plateau (Kosovich-Anderson and Weber 2011). Altitudinal update – 3200 m vs. “moderate to high elevations (500–3000 m)” (FNA 2014, p. 146).

Isopterygiopsis pulchella (Hedw.) Z.Iwats.

First record: 2008. Rare, from montane through the alpine; essentially arctic-alpine.

Muddy Creek: Lake Creek Waterfalls, steep bank of creek, on wet humus soil in shade under spruce, in splash zone of waterfall, 2009, 7500 ft, 5833, S+. **Deep Lake:** summits: alpine fen, on bare peaty bank of alpine pool, 2008, ! 10,400 ft (3170 m), 3275.

Note: Altitudinal update – 3170 m vs. “low to high elevations (10–2300 m)” (FNA 2014, p. 551).

* ** **Kiaeria blyttii** (Bruch & Schimp.) Broth.

First record: 2008. Sporadic; on soil in crevices of granite rocks, from montane through the subalpine; montane and arctic-alpine.

Muddy Creek: Ghost Creek, on rocks, 2008, 7900 ft, 3752. **Beartooth Butte:** boggy shore of Island Lake, on granite outcrops, 2008, 9500 ft, 2365; small subalpine lake, on rock, 2010, 9500 ft, 6846.

Note: An infrequently collected and a regionally rare species, also known in Wyoming from the Bighorn Mtns. (M. Lenz, personal communication, Kosovich-Anderson 2018).

* ** **Kiaeria starkei** (F.Weber & D.Mohr) I.Hagen

First record: 2008. Rare, single collection from alpine zone; montane and arctic-alpine.

Deep Lake: unnamed small alpine lake immediately S of Hwy 212, edge of lake, on peaty soil over acid rock, 2008, 10,000 ft, 2671.

Note: An infrequently collected species, rare in Wyoming, known in the state from a single station on the Beartooth Plateau (Kosovich-Anderson unpublished data).

Leptobryum pyriforme (Hedw.) Wilson

First record: 1953. Common; on clayey, sandy, gravelly, and peaty soil of creek banks and lake

shores, on decaying wood in forested areas, on disturbed substrates: near animals' burrows, dens and nests, on animal trails, and in different anthropogenic habitats, from foothills through the alpine. Sporophytes common.

Jim Smith Peak: Crazy Creek CG Swamp, 2008, 6950 ft, 3190, S+. **Muddy Creek:** W of Beartooth Butte, along the Clarks Fork, 1953, 6940 ft, *Lawton 2011* (WTU); Mud Lake Fen, 2008, 7750 ft, 3130, S+; Rd 801: swampy mixed forest, 2009, 7000 ft, 6165, S+; tributary of Beartooth Creek, 2010, 8450 ft, 7090; tributary of Gilbert Creek, 2010, 7800 ft, 7567, S+; "Beaver Lake", 2010, 7300 ft, 8336, S+. **Beartooth Butte:** Clay Butte Fen, 2008, 8950 ft, 2992, S+. **Deep Lake:** summits: unnamed alpine lake, 2008, 10,500 ft, 3502; Wyoming Creek-2, 2009, 10,600 ft, 5049; Top Lake Fen-2, 2010, 9450 ft, 7742, S+; tributary of Canyon Creek, 2010, 9400 ft, 7778.

Leptodictyum riparium (Hedw.) Warnst.

First record: 1953. Rare, from montane through the upper subalpine.

Muddy Creek: W of Beartooth, [Hwy 296], at Lake Creek, 1953, *Lawton 2042* (WTU). **Black Pyramid Mountain:** WY-MT state line: unnamed lake, in swale, 2010, ! 9750 ft (2970 m), 8089.

Note: Altitudinal update – 2970 m vs. "low to moderate elevations [0–1599 m]" (FNA 2014, p. 291).

* ** **Meesia longiseta** Hedw.

First record: 2002. Rare, in montane zone.

Jim Smith Peak: Little Moose Fen, 2002, 7960 ft, *Jackson s.n.* (RM), det. YKA. **Muddy Creek:** Ghost Creek Fen, *Drosera anglica* Huds./*Sphagnum warnstorffii* community, on soaked peaty soil, forms admixture with *Straminergon stramineum* (Dicks. ex Brid.) Hedenäs, 2008, 7900 ft, 3706.

Note: Regionally rare species of boreal, alpine, and arctic habitats, occurring in rich fens. Species of conservation concern in Montana (Elliott and Pipp 2019).

* ** **Meesia triquetra** (L. ex Jolycl.) Ångstr.

First record: 2008. Rare, single collection from montane zone.

Muddy Creek: Ghost Creek Fen, on soaked boggy soil, assoc.: *Scorpidium cossonii* (Schimp.) Hedenäs and *Aulacomnium palustre*, 2008, 7900 ft, 3711.

Note: A rich fen indicator species of basically arctic and boreal habitats. Disjunct in Wyoming, known from very few locations in the high mountains - on the Beartooth Plateau, Bighorn Mtns., and Wind River Range (Kosovich-Anderson unpublished data). Species of conservation concern in Montana (Elliott and Pipp 2019).

Meesia uliginosa Hedw.

First record: 2008. Sporadic; in rich subalpine and alpine fens and moist calcareous soil banks.

Deep Lake: Littlerock Creek Fen, 2008, 10,650 ft, 3636; head of Wyoming Creek, 2009, 10,600 ft, 4975.

Black Pyramid Mountain: WY-MT state line: unnamed lake, 2010, 9750 ft, 8091.

Meiotrichum lyallii (Mitt.) G.L.Merr.

[*Polytrichadelphus lyallii* Mitt., *Polytrichum lyallii* (Mitt.) Kindb.].

First record: 1953. Frequent; on soil and duff in old-growth subalpine spruce-fir forests, on soil of banks of lakes inlets and outlets in subalpine and alpine zones. E.

Beartooth Butte: Island Lake CG: spruce forest, 2008, 9500 ft, 2216; Beartooth Lake CG: coniferous forest, 2009, 8950 ft, 6230; 4WD Rd 149-1A: forested SW slope, 2010, 9650 ft, 7006. **Deep Lake:** [Hwy 212], near summit, 1953, ! 10,940 ft (3330 m), *Lawton 1983* (WTU); boggy area between two small alpine lakes along Hwy 212, 2008, 10,000 ft, 2678.1; Sawtooth Lake, 2009, 9300 ft, 6053; Top Lakes: old-growth spruce-fir forest, 2010, 9600 ft, 7694.

Note: Altitudinal update – 3330 m vs. "moderate to high elevations (900–3300 m)" (FNA 2007, p. 142).

Mnium arizonicum J.J.Amann

First record: 1953. Common; in the alpine and subalpine zones on soil over granite outcrops and in deeply shaded niches between granite debris in forested areas up to alpine tundra. E.

Muddy Creek: Lake Creek Waterfalls, 2009, 7500 ft, 5820; Beartooth Creek-3, 2010, 7550 ft, 7415; "Beaver Lake", 2010, 7250 ft, 8331. **Beartooth Butte:** granite ridge, W slope: coniferous forest, 2010, 9500 ft, 6932. **Deep Lake:** [Hwy 212], near summit, 1953, 10,950 ft, *Lawton 1977* (WTU); summits: alpine fen-1, 2008, 10,500 ft, 2292; ski-lift scenic point, alpine tundra, 2008, 10,900 ft, 2347; summits: granite outcrops in alpine tundra, 2008, 10,900 ft, 2532 (H, MO), det. T. Koponen; summits: alpine fen-4, 2008, 10,400 ft, 3278; summits: Overlook Roadside Park, alpine tundra, 2008, 10,950 ft, 3534; W summit and vicinity, 2010, 11,150 ft, 6685; summits: Stockade area, alpine tundra, 2010, 11,100 ft, 6699; Gravel Pit vicinity, alpine tundra, 2010, 10,400 ft, 7328. **Black Pyramid Mountain:** summits: alpine tundra-1, 2008, 10,200–10,300 ft, 2287.

Mnium blyttii Bruch & Schimp.

First record: 2008. Frequent; on wet soil in forested areas, preferring calcareous soil; along creeks and lakes, from montane through the subalpine; essentially arctic-alpine.

Jim Smith Peak: Crazy Creek CG Swamp, 2008, 6950 ft, 3187. **Muddy Creek:** Lake Creek Waterfalls, 2009, 7500 ft, 5808; tributary of Beartooth Creek, 2010, 8450 ft, 7056 (H, MO), det. T. Koponen. **Beartooth Butte:** pine forest along Hwy 212, 2008, 9000 ft, 3903; Clay Butte foothills: subalpine forest, 2009, 9000 ft, 5392; Beartooth Lake: W shore, 2010, 8900 ft, 6578.

Mnium lycopodioides Schwägr.

[*Mnium ambiguum* H.Müll.]

First record: 2009. Rare, at montane elevations; essentially arctic-alpine.

Jim Smith Peak: Crazy Creek-2, on soil over rocks, 2010, 6900 ft, 7956. **Muddy Creek:** Lake Creek

Waterfalls, on soil over granite boulders, in splash zone of waterfalls, 2009, 7500 ft, 5817.1 (H, MO), det. T. Koponen.

Mnium marginatum (Dicks.) P.Beauv.

First record: 1953. Frequent; on rotten logs, humus soil and duff in springy areas of old-growth subalpine spruce-fir forests, from montane through the subalpine; essentially arctic-alpine.

Jim Smith Peak: Crazy Creek, bank of creek, 1953, *Welch 16700* (WTU). **Muddy Creek:** Lake Creek Waterfalls, 2009, 7500 ft, 5817; tributary of Beartooth Creek-1, 2010, 8450 ft, 7058; Beartooth Creek-3, 2010, 7550 ft, 7411. **Beartooth Butte:** Little Bear Creek-4, 2009, ! 8950 ft (2730 m), 6224; tributary of Beartooth Creek-2, 2010, 7750 ft, 7396.

Note: Altitudinal update – 2730 m vs. “low to moderate elevations [0–1599 m]” (FNA 2014, p. 226).

* **Mnium spinulosum** Bruch & Schimp.

First record: 2010. Rare, single collection from montane zone.

Muddy Creek: outlet of Lily Lake, wet *Picea glauca*/*Alnus incana* forest, on forest floor, in partial shade, 2010, ! 7750 ft (2360 m), 7490, S+.

Note: Altitudinal update – 2360 m vs. “low to moderate elevations [0–1599 m]” (FNA 2014, p. 228) and 2200 m (Lawton 1971).

Mnium thomsonii Schimp.

First record: 1953. Common; on calcareous rock and soil along streams in forested areas from foothills through the subalpine, sometimes in alpine fens; arctic-alpine.

Jim Smith Peak: W of Beartooth Butte, Crazy Creek CG, 1953, *Lawton 2022* (WTU). **Muddy Creek:** W of Beartooth Butte, [Hwy 296], at Lake Creek, 1953, *Lawton 2089* (WTU); Lake Creek-1, 2010, 7700 ft, 7114; Rd 188: sparsely forested slope, 2010, 7600 ft, 7196; Beartooth Creek-3, 2010, 7550 ft, 7423; Gilbert Creek-2, 2010, 6900 ft, 8012. **Beartooth Butte:** Little Bear Creek-1, 2008, 9700 ft, 2686; Clay Butte Fen, 2008, 8950 ft, 2935; Beartooth Falls, 2009, 8900 ft, 5460; Beartooth Lake CG: coniferous forest, 2010, 8950 ft, 8261. **Deep Lake:** summits: alpine fen-4, 2008, 10,400 ft, 3278; Sawtooth Lake, 2009, 9300 ft, 6038.

* ** **Molendoa sendtneriana** (Bruch & Schimp.) Limpr.

First record: 2009. Rare, single collection from montane zone.

Muddy Creek: Lake Creek Waterfalls, splash zone of the waterfall, on a thick layer of humus-sandy soil over log, in shade under *Picea* sp., 2009, ! 7500 ft (2280 m), 5845.

Note: *Molendoa* Lindb. is a genus of mountain and arctic habitats, rarely collected in Wyoming. *Molendoa sendtneriana* is a regionally rare calciphilous montane species, known in Wyoming from very few stations (Kosovich-Anderson unpublished data), rare in Colorado (Weber and Wittmann 2007) and absent in a moss state list of Montana (Elliott and Pipp 2019). Altitudinal update – 2280 m vs. “low to high elevations (100–2000 m)” (FNA 2007, p. 564).

Myurella julacea (Schwägr.) Schimp.

First record: 2008. Sporadic; in alpine fen, tundra and drying bed of creek, as an admixture to other mosses.

Deep Lake: summits: dry creek in alpine tundra, 2008, 10,350 ft, 2440. **Black Pyramid Mountain:** summits: alpine tundra-4, 2008, 10,200–10,300 ft, 2459; summits: alpine fen-3, 2008, 10,100 ft, 2525.

Niphotrichum canescens (Hedw.) Bedn.-Ochyra & Ochyra

[*Racomitrium canescens* (Hedw.) Brid.]

First record: 1953. Sporadic; on wet ground in alpine tundra and in open subalpine sites.

Beartooth Butte: off Beauty Lake, on granite, 1953, *Welch 16833* (WTU). **Deep Lake:** ski-lift scenic point, alpine tundra, 2008, 10,900 ft, 2357 (1/2). **Unclear location:** Beartooth Plateau, 1973, 2900 m.s.m., *Weber B-44286* (COLO, RM).

Oncophorus virens (Hedw.) Brid.

First record: 1953. Common; on boggy soil in fens across subalpine and alpine zones, near streams, on moist rocks, rotten logs, more rare at lower elevations; arctic-alpine.

Muddy Creek: Beartooth Creek-3, 2010, 7550 ft, 7429 (US), det. R. Ireland, S+; Lake Creek-2, 2010, 6900 ft, 8408, S+. **Beartooth Butte:** up the Beartooth Butte, creek bank, 1953, *Welch 16670* (WTU); S slope of Beartooth Butte, 1953, *Lawton 2060* (WTU); Beartooth Lake: W shore, 2010, 8900 ft, 6603; boggy valley: small subalpine lake, 2010, 9500 ft, 6905; Chain Lake: S shore, 2010, 9480 ft, 6992, S+. **Deep Lake:** [Hwy 212], alpine bogs, head of Wyoming Creek, 3250 m.s.m., 1973, *Weber B-44223 & B-44264* (COLO, RM); summits: alpine fen-1, along pools, 2008, 10,500 ft, 2305; summits: alpine fen-5, 2008, 10,750 ft, 3433 (COLO); Littlerock Creek Fen, 2008, 10,650 ft, 3560; Sawtooth Lake, 2009, 9200 ft, 6003; inlet of Sawtooth Lake, 2009, 9400 ft, 6067; Long Lake, NW slope: willow wetlands, 2010, 9750 ft, 8297, S+. **Black Pyramid Mountain:** WY-MT state line: unnamed lake, 2010, 9800 ft, 8094 (CAS, COLO, DUKE, MONTU, US), ver. R. Ireland.

Oncophorus wahlenbergii Brid.

First record: 1973. Sporadic; on rotten logs along streams or in flooded areas, on soil, humus, rock or bark at the base of coniferous trees, from montane through the subalpine.

Muddy Creek: Rd 801: swampy mixed forest, 2009, 7050 ft, 6161. **Beartooth Butte:** [Hwy 212], subalpine zone between Long Lake and lower Sheepherder Lakes, 1973, 2900 m.s.m., *Weber B-44288* (COLO, RM); Little Bear Lake Fen, 2008, 9600 ft, 2834 (US), ver. R. Ireland, S+.

Orthotrichum alpestre Hornsch. ex Bruch & Schimp. First record: 2008. Sporadic; on rock debris in alpine tundra, on bases of trees and rocks in subalpine coniferous forests.

Beartooth Butte: Island Lake CG: spruce forest, 2008, 9550 ft, 2221, S+. **Deep Lake:** summits: dry

creek in alpine tundra, 2008, 10,350 ft, 2447; summits: alpine tundra-6, 2008, ! 10,850 ft (3310 m), 3381 S+.

Note: Altitudinal update – 3310 m vs. “high elevations (2100–3000 m)” (FNA 2014, p. 50).

Orthotrichum laevigatum J.E.Zetterst.

[*Lewinskya laevigata* (J.E.Zetterst.) F.Lara, Garilleti & Goffinet]

First record: 1953. Common; on granite boulders, outcrops and debris in dry, mesic, wet and swampy forests, in meadows, fens, and tundra; from foothills through the alpine. Sporophytes common.

Jim Smith Peak: Crazy Creek, on granite, 1953, *Welch 16695* (WTU); W of Beartooth Butte, Crazy Creek CG, 1953, *Lawton 2031* (WTU); Crazy Creek-1, 2009, 6950 ft, 5612, S+. **Muddy Creek:** W of Beartooth Butte, at Falls of Lake Creek, 1953, *Lawton 2086* (WTU); Lake Creek CG: wet coniferous forest, 2009, 6950 ft, 5933, S+. **Beartooth Butte:** W end of Beartooth Lake, 1953, *Lawton 1954* (WTU); NW side of Beartooth Lake, 1953, *Lawton 2076* (WTU); [Hwy 212], granite ridges with *Picea* and *Pinus flexilis*, vicinity of Long Lake and lower Sheepherder Lakes, 1973, 2900 m.s.m., *Weber B-44240 & B-44283* (COLO, RM); Island Lake CG: spruce forest, 2008, 9550 ft, 2222, S+. **Deep Lake:** [Hwy 212], near summit, 1953, ! 10,950 ft (3340 m), *Lawton 2139* (WTU); summits: alpine tundra-3, 2008, 10,350 ft, 2397, det. D. Vitt, S+; dry creek in alpine tundra, 2008, 10,350 ft, 2437, S+; summits: alpine tundra-5, 2008, 10,700 ft, 3334, S+. **Black Pyramid Mountain:** summits: alpine tundra-1, 2008, 10,200 ft, 2282, S+; summits: alpine fen-3, 2008, 10,100 ft, 2516; summits: alpine tundra-4, 2008, 10,200–10,300 ft, 2476, det. D. Vitt.

Note: Altitudinal update – 3340 m vs. “moderate to high elevations (500–3000 m)” (FNA 2014, p. 58).

Orthotrichum rupestre Schleich. ex Schwägr.

[*Lewinskya rupestris* (Schleich. ex Schwägr.) F.Lara, Garilleti & Goffinet]

First record: 1953. Frequent; on granite rock overhang in mesic forested areas, rarely at the base of trees, from foothills through the alpine.

Jim Smith Peak: W of Beartooth [Butte], Crazy Creek CG, 1953, *Lawton 2017 & 2030* (WTU); Crazy Creek-2, 2010, 6900 ft, 7968, S+. **Muddy Creek:** [Hwy 296], at Lake Creek, 1953, *Welch 16741* (WTU); Lewis and Clark Trail: Douglas-fir forest, 2009, 6800 ft, 6178, ver. D. Vitt, S+. **Black Pyramid Mountain:** summits: alpine tundra-4, 2008, 10,200–10,300 ft, 2476; summits: alpine fen-3, 2008, 10,100 ft, 2501, S+.

Orthotrichum speciosum Nees

[*Lewinskya speciosa* (Nees) F.Lara, Garilleti & Goffinet]

First record: 2008. Rare, two collections from montane and alpine elevations.

Muddy Creek: Lake Creek CG: wet coniferous forest, on boulder, 2009, 6950 ft, 5933, det. D. Vitt. **Deep**

Lake: summits: alpine tundra-3, in crevice of granite rock, 2008, ! 10,350 ft (3150 m), 2399, S+.

Note: Altitudinal update – 3150 m vs. “low to high elevations (10–2000 m)” (FNA 2014, p. 67).

* **Paludella squarrosa** (Hedw.) Brid.

First record: 2002. Sporadic; in shallow water of montane and subalpine fens fed by spring water and snowmelt, semi-submerged above the late summer water table; boreal to arctic-alpine or montane-alpine.

Jim Smith Peak: Little Moose Peatland, 2002, 7960 ft, *Jackson s.n.* (RM), det. J. Harpel. **Beartooth Butte:** boggy valley of unnamed lake (“Paludella Lake”), 2010, 9500 ft, 6921 (COLO); Chain Lake: S shore, 2010, 9500 ft, 6989. **Deep Lake:** Sawtooth Palsa Fen (Heidel et al. 2008). **Black Pyramid Mountain:** WY-MT state line: unnamed lake, 2010, 9750 ft, 8064.

Palustriella falcata (Brid.) Hedenäs

[*Cratoneuron commutatum* var. *falcatum* (Brid.) Mönk.]

First record: 1953. Common in Beartooth Butte Quadrangle; in calcium-rich habitats, in springs, boggy streams, on wet rocks and creek banks in forested areas, from montane to subalpine elevations.

Beartooth Butte: W end of Beartooth Lake, 1953, *Lawton 1956* (WTU); S slope of Beartooth Butte, 1953, *Lawton 2048* (WTU), S+, det. as *Palustriella decipiens* (DeNot.) Ochrya; Beartooth Butte, 1953, *Welch 16807* (WTU); Beartooth Butte, S slope, lower altitude, 1953, *Lawton s.n.* (MO); Beartooth Butte, 1953, 8000–9000 ft, *Conard s.n.* (NY); near Beartooth Lake, 1953, *Welch 16604* (FLAS); Clay Butte Fen, 2008, 8950 ft, 2990; Little Bear Creek-2, 2008, 9500 ft, 3235; creek SW of Beartooth Butte, 2008, 9500 ft, 3856; Clay Butte foothills: subalpine forest, 2009, 9000 ft, 5396; Beartooth Lake: W shore, 2010, 8900 ft, 6562.

Paraleucobryum enerve (Thed.) Loeske

First record: 1973. Sporadic; on soil over granite boulders, outcrops and cliffs, on stream banks, in upper subalpine and alpine zones; essentially arctic-alpine.

Beartooth Butte: Little Bear Creek-1, steep rocky terrace along the creek, N-facing granite cliff, 2008, 9700 ft, 2712 (½) (CAS, COLO, MO, US), ver. R. Ireland. **Deep Lake:** [Hwy 212], alpine bogs of E summit, head of Wyoming Creek, 1973, 3250 m.s.m., *Weber B-44256* (COLO, RM, WTU), annot. P. Eckel; ski-lift scenic point, alpine tundra, 2008, 10,900 ft, 2357 (½) (COLO).

* **Philonotis caespitosa** Jur.

First record: 2008. Sporadic; on wet soil of streams banks and ditches, from montane through the alpine.

Jim Smith Peak: Crazy Creek-2, 2010, 6900 ft, 7959. **Beartooth Butte:** Little Bear Lake Fen, 2008, 9600 ft, 2901. **Deep Lake:** inlet of Frozen Lake, 2008, 10,350–10,550 ft, 2540.

Philonotis fontana (Hedw.) Brid.

- **var. fontana**

First record: 1953. Common; in seepy habitats, on rocks and clayey, sandy, gravelly and peaty soil along lake shores and stream banks, in willow communities at all elevations.

Jim Smith Peak: Little Moose Lake Fen (Heidel et al. 2008). **Muddy Creek:** Gilbert Creek-2, 2010, 6900 ft, 8005. **Beartooth Butte:** S slope of Beartooth Butte, 1953, *Lawton 2057* (WTU); NW side of Beartooth Lake, 1953, *Lawton 2080* (WTU); Beauty Lake Trail, 2009, 8900 ft, 5244; Beartooth Falls, 2009, 8900 ft, 5434; creek connecting Fort and Chain Lakes, 2010, 9500 ft, 7792. **Deep Lake:** below Beartooth Pass, 38 mi NW of Cody, tundra, 1965, 10,000 ft, *Hermann 20074* (NY, WTU), det. W.M. Zales; S of Sawtooth Mt., wet boggy area, 2007, 9800 ft, *E.Elliott, Heidel & B.Elliott 3588* (RM), det. YKA; summits: alpine fen-2, 2008, 10,600 ft, 2326 (H, MO), det. T. Koponen; inlet of Frozen Lake, 2008, 10,550 ft, 2562; summits: wet alpine meadow, 2008, 10,750 ft, 3395; Wyoming Creek-1, 2008, 10,300 ft, 3463; Sawtooth Palsa Fen, 2009, 9650 ft, 5694; summits: snow-melt rill, 2010, 10,600 ft, 6724 (H, MO), det. T. Koponen; Dollar Lake: SW shore, 2010, 9400 ft, 7755.

* - **var. americana** (Dism.) Flowers ex H.A.Crum [*Philonotis americana* Dism.]

First record: 2009. Rare, single collection from subalpine zone.

Beartooth Butte: Little Bear Creek-3, moss-lined bank of creek, in shade, on wet humus, 2009, 9400 ft, 5382 (H, MO), det. T. Koponen.

- **var. pumila** (Turner) Brid.

[*Philonotis tomentella* Molendo]

First record: 1953. Frequent; in springs, flushes, wet clayey and gravelly soil, seepage zones on fens at montane through the alpine, especially at late snow-melt areas; essentially arctic-alpine.

Muddy Creek: Hwy 212 and Rd 188 intersection: boggy valley, 2010, 7550 ft, 7217. **Beartooth Butte:** Beartooth Butte, 1953, 9000 ft, *Lawton 2053* (WTU); boggy shore of Island Lake, 2008, 9500 ft, 2367; Little Bear Lake Fen, 2008, 9600 ft, 2757; Island Lake CG: subalpine meadow, 2008, 9500 ft, 2924. **Deep Lake:** [Hwy 212], alpine bogs, head of Wyoming Creek, 1973, 3250 m.s.m., *Weber 44262* (COLO, RM); Littlerock Creek Fen (Heidel et al. 2008); inlet of Frozen Lake, 2008, 10,350–10,550 ft, 2606; two alpine lakes along Hwy 212, 2008, 10,000 ft, 2657.

* ** **Philonotis yezoana** Besch. & Cardot

First record: 2009. Rare, two collections from Lake Creek, in montane zone.

Muddy Creek: Lake Creek Waterfalls, splash zone, sheltered granite outcrops lining the creek, under the steep creek bank, forested by *Picea* sp., *Pseudotsuga menziesii*, and *Pinus contorta*, 2009, 7500 ft, 5849 (COLO, DUKE); Lake Creek-2, on steep rocky bank

forested with *Picea* sp., over rock on a patch of soil, in shade, 2010, 6900 ft, 8397.

Note: A rare species of temperate habitats with primarily oceanic distribution; global conservation rank – G3. Wyoming population was discovered in the interior mountains of the state, approximately 500 km south-southeast of Montana's and east-southeast of Idaho's nearest known locations. The plants on Lake Creek grow in typical conditions for the species – on shaded granite rocks in spray-moist zone of rapids of creek (Kosovich-Anderson and Weber 2011) (Fig. 4B).

** **Plagiobryum zierii** (Dicks. ex Hedw.) Lindb.

First record: 2010. Rare, single collection from montane zone; arctic-alpine or montane-alpine.

Jim Smith Peak: Crazy Creek-2, cataracts, on shady seeping granite cliffs lining the creek, 2010, 6900 ft, 7972 (ASC, COLO), det. J. Spence.

Note: A rare species with disjunct worldwide distribution in Eurasia, Africa and North and Central America, typically growing on wet dripping rocks. In Colorado, it is an “extremely rare species of subalpine seeping cliffs and moist tundra” (Weber and Wittmann 2007, p. 55). The only known occurrence of species in Wyoming is at Crazy Creek on the Beartooth Plateau (Kosovich-Anderson unpublished data).

Plagiomnium ellipticum (Brid.) T.J.Kop.

[*Mnium ellipticum* Brid., *Plagiomnium rugicum* (Laurer) T.J.Kop.]

First record: 1973. Common; minerotrophic fens, willow carrs, along rills and snowbeds at high elevations, in seepage areas and on wet soil, decaying wood and duff in shady coniferous forests, from foothills through the alpine.

Jim Smith Peak: Crazy Creek CG Swamp, 2008, 6950 ft, 3166. **Muddy Creek:** Ghost Creek Fen, 2008, 7900 ft, 3731; Lewis and Clark Trail: swampy mixed forest, 2009, 6600 ft, 6186 (H, MO), det. T. Koponen.

Beartooth Butte: Fantan North Fen (Heidel et al. 2008); Clay Butte Fen, 2008, 8950 ft, 2955, S+; Meadow Lake Fen, 2008, 9850 ft, 3772; Beartooth Falls, 2009, 8900 ft, 5463. **Deep Lake:** [Hwy 212], alpine bogs, head of Wyoming Creek, 1973, 3250 m.s.m., *Weber B-44255 & B-44258* (COLO, RM); W side of Beartooth Pass, under late snow patch, 1973, 3200 m.s.m., *Weber B-44304* (COLO, RM); summits: alpine fen-1, 2008, 10,500 ft, 2322; Littlerock Creek Fen, 2008, ! 10,650 ft (3240 m), 3606; Wyoming Creek-2, 2009, 10,600 ft, 4973; Sawtooth Palsa Fen, 2009, 9700 ft, 5711; Dollar Lake: SW shore, 2010, 9400 ft, 7753. **Black Pyramid Mountain:** WY-MT state line: unnamed lake, 2010, 9750 ft, 8081.

Note: Altitudinal update – 3240 m vs. “low elevations [0–199 m]” (FNA 2014, p. 233).

* **Plagiomnium rostratum** (Schrad.) T.J.Kop.

[*Mnium rostratum* Schrad.]

First record: 2009. Sporadic; mainly on calcareous rocks and soil in woods, willow thickets, in montane and subalpine zones.

Muddy Creek: tributary of Beartooth Creek, 2010, 8400 ft, 7057. **Beartooth Butte:** Clay Butte foothills: subalpine forest, 2009, ! 9000 ft (2740 m), 5414; Beartooth Lake: W shore, 2010, 8900 ft, 6566.

Note: Altitudinal update – 2740 m vs. “low to moderate elevations [0–1599 m]” (FNA 2014, p. 234).

Plagiothecium denticulatum (Hedw.) Schimp.

First record: 2008. Common; in shady, wet and swampy woods (spruce, spruce-fir, pine, and Douglas-fir): on soil, rotten logs, trunks, overturned stumps, duff, bare roots, bases of trees and shrubs, humus soil overlying granite boulders, especially at streamsides; also on soil in deeply shaded niches between granite rocks in alpine tundra and subalpine/alpine fens.

Muddy Creek: Lake Creek-1, 2010, 7700 ft, 7116.

Beartooth Butte: Little Bear Creek-1, 2008, 9700 ft, 2685; Meadow Lake Fen, 2008, 9850 ft, 3764; Beauty Lake Trail, 2009, 8950 ft, 5222; Fantan Lake: E shore, 2010, 9500 ft, 6892; Little Bear Lake: SE shore, 2010, 9650 ft, 8317. **Deep Lake:** Sawtooth Palsa Fen, 2009, 9700 ft, 5735; Lake WGN Fen, 2009, 9600 ft, 6073; W summit and vicinity, 2010, ! 11,100 ft (3380 m), 6668; Lower Top Lake Fen, 2010, 9450 ft, 7685; Long Lake, NW slope: willow wetlands, 2010, 9750 ft, 8293.

Note: Altitudinal update – 3380 m vs. “low to high elevations (50–2700 m)” (FNA 2014, p. 487).

Platydictya jungermannioides (Brid.) H.A.Crum

[*Amblystegiella sprucei* (Spruce) Loeske]

First record: 2010. Rare, in montane and subalpine zones.

Jim Smith Peak: Crazy Creek-2, on wet shade rocks along stream, 2010, 6900 ft, 7979, propagula.

Beartooth Butte: Beartooth Lake: W and SW shore, along stream, on wet granite outcrops and boulders covered with a layer of humus, assoc.: *Cratoneuron filicinum*, 2010, 8900 ft, 6575, propagula.

Pleurozium schreberi (Willd. ex Brid.) Mitt.

First record: 2007. Sporadic; on humus, soil and duff in wet coniferous forests, at foothills and montane elevations.

Jim Smith Peak: between Reed Lake and Rock Creek, 2007, 7550–7750 ft, *E.Elliott, B.Elliott & Heidel* 3819 (RM), det. YKA; Crazy Creek CG Swamp, 2008, 6950 ft, 3212 (CAS, COLO); Crazy Creek-2, 2010, 6900 ft, 7998 (CAS, COLO, DUKE, MO). **Muddy Creek:** Lily Lake Swamp Forest, 2008, 7750 ft, 3025.

* **Pogonatum urnigerum** (Hedw.) P.Beauv.

First record: 2008. Rare, single collection from upper subalpine elevation.

Beartooth Butte: Little Bear Creek-1, steep rocky terrace, forested with *Picea engelmannii*, on N-facing ledge of granite cliff, inside the tightly compacted tufts of *Paraleucobryum enerve*, 2008, 9700 ft, 2712 (½) (COLO, MO) (Kosovich-Anderson 2011c).

* **Pohlia annotina** (Hedw.) Lindb.

First record: 2009. Rare, from montane through the subalpine.

Jim Smith Peak: Crazy Creek-2, on clayey soil over rock, 2010, 6900 ft, 7943, gemm. **Beartooth Butte:** unnamed creek/“Dichelyma Creek-1”, on sandy bank, 2009, 9500 ft, 6095, gemm.

Pohlia bolanderi (Lesq.) Broth.

First record: 1953. Frequent; in soil-filled rock crevices in different plant communities, and on dry alpine soil, mainly at subalpine and alpine elevations.

Muddy Creek: W of Beartooth Butte, [Hwy 296], at Lake Creek, 1953, *Lawton* 2090 (WTU). **Beartooth Butte:** Little Bear Lake Fen, 2008, 9600 ft, 2807; Little Bear Creek-2, 2008, 9500 ft, 3255. **Deep Lake:** summits: alpine fen-4, 2008, 10,400 ft, 3304 (DUKE), det. J. Shaw; summits: alpine fen-5, 2008, 10,750 ft, 3461 (DUKE), det. J. Shaw, S+; Sawtooth Lake, 2009, 9250 ft, 5992; Hwy 212: roadside granite debris, 2010, 10,200 ft, 6733; Gravel Pit vicinity, alpine tundra, 2010, 10,400 ft, 7270; Long Lake, NW slope: willow wetlands, 2010, 9750 ft, 8292. **Black Pyramid Mountain:** summits: alpine tundra-4, 2008, 10,200–10,300 ft, 2458.

Note: Global conservation rank – G3 (vulnerable); however, the species is not infrequent in Wyoming where it occurs in high mountains (Kosovich-Anderson unpublished data).

Pohlia cruda (Hedw.) Lindb.

First record: 1953. Common; on soil banks, crevices in rocks and under tree roots in forested areas, decorticated downed wood, tundra soil and paths, from foothills through the alpine.

Jim Smith Peak: Crazy Creek-2, 2010, 6900 ft, 7936.

Muddy Creek: Lily Lake Swamp Forest, 2008, 7750 ft, 3035; Ghost Creek Fen, 2008, 7900 ft, 3747; Lake Creek-1, 2010, 7700 ft, 7120. **Beartooth Butte:** near Beartooth Lodge, beside stream, 1953, 9000 ft, *Lawton* 1937 (WTU); Island Lake: boggy shore, 2008, 9500 ft, 2385; Little Bear Creek-1, 2008, 9700 ft, 2693; Beartooth Falls, 2009, 8900 ft, 5460; granite ridge: coniferous forest, 2010, 9550 ft, 6930. **Deep Lake:** Littlerock Creek Fen, 2008, 10,650 ft, 3609; Sawtooth Lake, 2009, 9300 ft, 5992; Gravel Pit vicinity, alpine tundra, 2010, 10,400 ft, 7256; summits: alpine tundra-13, 2010, 10,900 ft, 8201. **Black Pyramid Mountain:** summits: alpine fen-3, 2008, 10,100 ft, 2492; WY-MT state line: unnamed lake, 2010, 9800 ft, 8077.

Pohlia drummondii (Müll.Hal.) A.L.Andrews

First record: 1953. Frequent; on acidic soils, in shaded crevices of granite outcrops, on wet loamy soil and burned wood in subalpine spruce-fir forests, in snowbeds and on stream banks in alpine tundra; arctic-alpine. Gemmae common.

Beartooth Butte: along stream near Beartooth Lodge, 1953, 2750 m, *Lawton* 1933 (WTU), S+; [Hwy 212], subalpine zone between Long Lake and lower Shepherd Lakes, 1973, 2900 m.s.m., *Weber* B-44273 (COLO), det. J. Shaw; Island Lake CG: spruce

forest, 2008, 9500 ft, 2216 (DUKE), det. J. Shaw, gemm.; Island Lake, boggy shore, 2008, 9500 ft, 2388, gemm. **Deep Lake**: summits: alpine fen-2, 2008, 10,850 ft, 2337 (DUKE), det. J. Shaw, gemm.; summits: granite outcrops in alpine tundra, 2008, 10,900 ft, 3492 (DUKE), det. J. Shaw, gemm. **Black Pyramid Mountain**: summits: alpine tundra-1, 2008, 10,200–10,300 ft, 2270, gemm.

**** *Pohlia longicolla* (Hedw.) Lindb.**

First record: 1953. Rare, single collection, elevation unknown.

Beartooth Butte: N side of Beartooth Lake, 1953, *Lawton 2081* (WTU), det. J. Shaw.

Note: A circumboreal mountain species; according to FNA (2014), relatively rare in North America. Distribution in Wyoming is poorly studied.

**** *Pohlia ludwigii* (Spreng. ex Schwägr.) Broth.**

First record: 2008. Sporadic; on soaked soil along fen and streams at subalpine and alpine elevations, alpine or arctic-alpine.

Beartooth Butte: Meadow Lake Fen, 2008, 9850 ft, 3811; creek SW of Beartooth Butte, 2008, 9500 ft, 3859. **Deep Lake**: inlet of Frozen Lake, 2008, 10,350–10,550 ft, 2572.

Note: A rare alpine species, characteristic for late snow-melt areas in alpine and subalpine zones (FNA 2014). According to Savich-Lyubitskaya and Smirnova (1970), the species has an arctic-alpine distribution.

***Pohlia nutans* (Hedw.) Lindb.**

First record: 1953. Common; on soil banks, logs, tree bases in forested areas, in subalpine meadows shrublands, in various disturbed habitats in alpine tundra. Sporophytes common.

Muddy Creek: Ghost Creek Fen, 2008, 7900 ft, 3754, S+. **Beartooth Butte**: Beartooth Lake, near Lodge, 1953, *Lawton s.n.* (MO), det. E. Whitehouse; Little Bear Lake Fen, 2008, 9600 ft, 2755 (DUKE), det. J. Shaw; Beauty Lake Trail, 2009, 8950 ft, 5218; Beartooth Falls, 2009, 8900 ft, 5453; Fantan South Fen, 2010, 9500 ft, 6982, S+. **Deep Lake**: summits: alpine fen-5, 2008, 10,750 ft, 3451, S+; Wyoming Creek-1, 2008, 10,300 ft, 3472 (DUKE), det. J. Shaw; Sawtooth Palsa Fen, 2009, 9700 ft, 5734, S+; Lake WGN Fen, 2009, 9600 ft, 6073, S+; summits: Stockade area, alpine tundra, 2010, 11,150 ft, 6716; Top Lake, N slope: subalpine meadow, 2010, 9500 ft, 7749, S+; tributary of Canyon Creek, 2010, 9400 ft, 7776.

**** *Pohlia obtusifolia* (Vill. ex Brid.) L.F.Koch**

First record: 1973. Sporadic; on soil in late snow-melt areas, rills and snowbeds, in subalpine and alpine zone; arctic-alpine.

Beartooth Butte: Meadow Lake Fen, 2008, 9850 ft, 3770. **Deep Lake**: [Hwy 212], W side, under late snow patch, 1973, 3200 m.s.m., *Weber B-44319* (COLO), det. J. Shaw; summits: alpine fen-5, 2008, 10,750 ft, 3450 (DUKE), det. J. Shaw, S+; Wyoming Creek-2, 2009, 10,600 ft, 5011.

Note: A rare species with disjunctive distribution in arctic and, mainly, subarctic mountains; global conservation rank – G3; known in Wyoming from very few locations – all at upper subalpine and alpine elevations (Kosovich-Anderson unpublished data).

*** *Pohlia proligera* (Kindb. ex Breidl.) Lindb. ex Arnell**

First record: 2008. Rare, single collection from subalpine zone.

Beartooth Butte: Little Bear Creek-2, sandy soil on stream bank, 2008, 9500 ft, 3255, gemm.

**** *Pohlia tundrae* A.J.Shaw**

First record: 1988. Rare, in subalpine zone; arctic-alpine.

Beartooth Butte: unnamed creek/“Dichelyma Creek-1”, on soil over granite rocks lining the creek, 2009, 9500 ft, 6085, gemm. **Deep Lake**: Morrison Jeep Trail, at S end of Plateau, meadow, on humus-rich soil over granite rock debris, 1988, 9300 ft, *Hartman* (with *Houston*) 23782 (RM), det. YKA, gemm.

Note: A rare species with global conservation rank G2 (imperiled). Occurs in Wyoming’s Rocky Mountains, where it is infrequent (Kosovich-Anderson unpublished data).

***Pohlia wahlenbergii* (F.Weber & D.Mohr) A.L.Andrews**

First record: 2008. Common; in swales on fens, on moist clayey or sandy soil along streams, path banks, in riparian willow communities and willow carrs, in calcareous seeps, late snow-melt meadows and along muddy banks in alpine zone.

Muddy Creek: Muddy Creek-1, 2009, 8100 ft, 6146; tributary of Beartooth Creek-1, 2010, 8400 ft, 7070.

Beartooth Butte: Little Bear Creek-2, 2008, 9500 ft, 3261; Clay Butte: slope facing to E, 2008, 9700 ft, 3846 (DUKE), det. J. Shaw; Fantan Lake: N shore, 2010, 9500 ft, 7012. **Deep Lake**: summits: alpine fen-2, 2008, 10,800 ft, 2337 (DUKE), det. J. Shaw; summits: inlet of Frozen Lake, 2008, 10,350–10,550 ft, 2602 (COLO, DUKE), det. J. Shaw; alpine fen-5, 2008, 10,750 ft, 3414 (DUKE), det. J. Shaw, S+; Wyoming Creek-1, 2008, 10,300 ft, 3471 (DUKE), det. J. Shaw; summits: snow-melt rill, 2010, 10,600 ft, 6727; Top Lake Fen-2, 2010, 9450 ft, 7720; head of unnamed creek-2, 10,300 ft, 2010, 8240.

***Polytrichastrum alpinum* (Hedw.) G.L.Sm.**

[*Polytrichum alpinum* Hedw.]

*** - var. *alpinum***

First record: 2008. Rare, single collection from alpine zone.

Beartooth Butte: Meadow Lake Fen, on boggy soil, 2008, 9850 ft, 3771.

- var. *septentrionale* (Sw. ex Brid.) G.L.Sm.

First record: 1953. Common; on rocky ridgecrests and slopes, outcrops, stabilized talus, in subalpine forests, alpine meadows, tundra and fens, especially in late snow-melt areas and snowbeds; arctic-alpine.

Beartooth Butte: Little Bear Lake Fen, 2008, 9600 ft, 2799; Chain Lake: S shore, 2010, 9450 ft, 6990. **Deep Lake:** [Hwy 212], E of summit, near small glacial lake, 1953, 10,500 ft, *Lawton 1964* (WTU); near summit, 1953, 11,000 ft, *Lawton 2142* (WTU); [Hwy 212], 1973, 3200 m.s.m., *Weber, B-44315* (COLO, RM); ca 2 air mi ENE of Beartooth Pass, wet alpine meadows, 2008, approx. 10,600–10,800 ft, *Elliott 14628* (RM), det. YKA, S+; Sawtooth Palsa Fen (Heidel et al. 2008); ski-lift scenic point, alpine tundra, 2008, 10,900 ft, 2345; Littlerock Creek Fen, 2008, 10,650 ft, 3618; Lake WGN Fen, 2009, 9600 ft, 6073; W summit and vicinity, 2010, 11,100 ft, 6675; summits: Stockade area, alpine tundra, 2010, 11,050 ft, 6713; Lower Top Lake Fen, 2010, 9450 ft, 7685; tributary of Canyon Creek-2, 2010, 9400 ft, 7776.

Polytrichastrum longisetum (Sw. ex Brid.) G.L.Sm.
[*Polytrichum longisetum* Sw. ex Brid.]

First record: 1984. Frequent; on boggy soil in subalpine and alpine fens.

Jim Smith Peak: Ivy Lake: SE edge, 2010, 8000 ft, 7528. **Beartooth Butte:** Little Bear Lake Fen, 2008, 9600 ft, 2850 (½) (CAS, COLO, MO, VBGI), S+. **Deep Lake:** S of Sawtooth Mt., palsa peatbeds, 2007, 9800 ft, *Elliott 3566.1* (RM), det. YKA, S+; Littlerock Creek Fen, 2008, 10,650 ft, 3619, S+; Canyon Creek, 2009, 9400 ft, 5669; Sawtooth Palsa Fen, 2009, 9700 ft, 5744; creek connecting Lower Top and Sawtooth Lakes, 2010, 9450 ft, 7620; Lower Top Lake Fen, 2010, 9450 ft, 7663. **Unclear location:** Beartooth Mts., 1984, 9700 ft, *Hartman 18542* (RM). Note: Morphological features in specimen 3619: capsules 2–3 mm long and seta 2–2.5 cm vs. capsules 3–5 mm long and seta 4–7 cm, as described in FNA (2007).

Polytrichastrum sexangulare (Flörke ex Brid.) G.L.Sm.

[*Polytrichum sexangulare* Flörke ex Brid.]

First record: 1953. Frequent; in snowbeds and on rocky banks of streamlets in late snow-melt areas, on moist soil on solifluction terraces in alpine zone; essentially arctic-alpine.

Beartooth Butte: Little Bear Lake Fen, 2008, 9600 ft, 2617. **Deep Lake:** [Hwy 212], E of summit, near small glacial lake, 1953, 10,500 ft, *Lawton 1973* (WTU); inlet of Frozen Lake, seepage slope, 2008, 10,400–10,500 ft, 2632 (MO), det. B. Allen; Littlerock Creek Fen, 2008, 10,650 ft, 3581; Wyoming Creek-2, 2009, 10,600 ft, 4990, S+; Gravel Pit vicinity, alpine tundra, 2010, 10,400 ft, 7276.

Polytrichum commune Hedw.

First record: 2009. Rare, in montane and subalpine zones.

Jim Smith Peak: Ivy Lake: SE edge, along lake shore, on soaked peaty soil, not abundant, 2010, 8000 ft, 7527. **Deep Lake:** Morrison Jeep Trail, Top Lake Fen-1, SW boggy shore of lake, on wet peaty soil, in low hummock, assoc.: *Sphagnum angustifolium*, 2009, ! 9450 ft (2880 m), 5773 (½).

Note: Altitudinal update – 2880 m vs.: “low to moderate elevations [0–1599 m]” (FNA 2007, p. 136), 2600 m (Hermann 1987), and 2650 m (Flowers 1973).

Polytrichum juniperinum Hedw.

First record: 1953. Common; a cosmopolitan and almost weedy moss, on a variety of substrates, including disturbed ones, in different communities, but tends to avoid excessively dry or exposed sites, from foothills through the alpine. Sporophytes common.

Jim Smith Peak: Ivy Lake: SE edge, 2010, 8000 ft, 7563, S+. **Muddy Creek:** Lily Lake Fen, 2008, 7750 ft, 3067, S+; SE slope: sagebrush thickets, 2010, 7750 ft, 7407. **Beartooth Butte:** Clay Butte Fen, 2008, 9000 ft, 2925, S+; Little Bear Creek-2, 2008, 9500 ft, 3239; Meadow Lake Fen, 2008, 9850 ft, 3768, S+; 4WD Rd 149: roadside tundra communities, 2009, 9700 ft, 6097; Fantan South Fen, 2010, 9500 ft, 6980. **Deep Lake:** summit, near glacial lake, 1953, 10,500 ft, *Lawton 1969* (WTU); S of Sawtooth Mt., palsa peatbeds, 2007, 9800 ft, *Elliott 3565* (RM), det. YKA, S+; ski-lift scenic point, alpine tundra, 2008, 10,900 ft, 2347; summits: wet alpine meadow, 2008, 10,750 ft, 3398; summits: Overlook Roadside Park, alpine tundra, 2008, 10,950 ft, 3535; Canyon Creek, 2009, 9400 ft, 5682; Sawtooth Lake, 2009, 9300 ft, 5992; Lake WGN Forest, 2009, 9600 ft, 6079, S+. **Black Pyramid Mountain:** summits: alpine tundra-1, 2008, 10,200–10,300 ft, 2280.

Polytrichum piliferum Hedw.

First record: 1953. Common; on rocky ridgecrests and slopes, stabilized talus, on shallow well-drained sandy or gravelly soils over granite rocks and boulders in forests and sagebrush thickets, on solifluction terraces in alpine tundra; often associated with lichens and *Selaginella* P.Beauv., spp., a dominant of poor soil cover on wind-swept summits.

Jim Smith Peak: Ivy Lake: SE edge, 2010, 8000 ft, 7564, S+. **Muddy Creek:** SE slope: sagebrush thickets, 2010, 7750 ft, 7406. **Beartooth Butte:** Beartooth Lodge, 1953, *Lawton 1938* (WTU); E of Beartooth Lake, Beartooth Pass, 1953, *Lawton s.n.* (MO); Island Lake CG: spruce forest, 2008, 9500 ft, 2220; 4WD Rd 120: roadside tundra communities, 2009, 9700 ft, 5642A, S+. **Deep Lake:** summit, rock crevice, 1953, 11,000 ft, *Welch 16648* (WTU); [Hwy 212], near summit, 1953, 10,940 ft, *Lawton 1988* (WTU); near summit, 1953, 11,000 ft, *Lawton 2140* (WTU); E of summit, 1953, 10,500 ft, *Lawton 1968* (WTU), S+; Beartooth Pass, 48 km E of Cooke City, alpine meadow, 1993, 3340 m, *Eversman 93192* (ISC), det. D.G. Horton; Sawtooth Palsa Fen (Heidel et al. 2008); ski-lift scenic point, alpine tundra, 2008, 10,900 ft, 2353; summits: Overlook Roadside Park, alpine tundra, 2008, 10,950 ft, 3536; W summit and vicinity, 2010, ! 11,100 ft (3380 m), 6664; Gardner Lake: head of USFS Trail, 2010, 10,600 ft, 8183. **Black Pyramid Mountain:** summits: alpine tundra-1, 2008, 10,200–10,300 ft, 2270 (CAS, COLO, MO);

summits: alpine tundra-4, 2008, 10,300 ft, 2467; WY-MT state line: unnamed lake, 2010, 9800 ft, 8100.

Note: Altitudinal update – 3380 m vs. “low to moderate elevations [0–1599 m]” (FNA 2007, p. 140).

Polytrichum strictum Menzies ex Brid.

[*Polytrichum affine* Funck, *P. juniperinum* var. *affine* (Funck) Brid.].

First record: 1953. Common; in moist tundra, on rotten stumps in old-growth spruce-fir forests, on *Sphagnum* fens, in subalpine and alpine zones.

Beartooth Butte: Fantan Lake: E shore, 2010, 9500 ft, 6867. **Deep Lake:** [Hwy 212], Beartooth Lake, W end, 1953, *Lawton 1961* (WTU); summit near glacial lake, 1953, 10,500 ft, *Lawton 1965* (WTU); Sawtooth Palsa Fen (Heidel et al. 2008); Littlerock Creek Fen, 2008, 10,650 ft, 3588, S+; Lake WGN Fen, 2009, 9600 ft, 6071; Gravel Pit vicinity, alpine tundra, 2010, 10,400 ft, 7291; Top Lake Fen-2, 2010, 9450 ft, 7717. **Black Pyramid Mountain:** WY-MT state line: unnamed lake, 2010, 9800 ft, 8069. **Unclear locations:** [Hwy 212], 1973, 3250 m.s.m., *Weber B-44259* (COLO, RM); Beartooth Mtns., 1984, *Hartman 18541* (RM).

**** Pseudocalliergon angustifolium** Hedenäs

[*Drepanocladus angustifolius* (Hedenäs) Hedenäs & Rosborg]

First record: 2008. Sporadic; on soaked boggy soil and in shallow wet depressions of minerotrophic fens, in subalpine and alpine zone.

Deep Lake: summits: alpine moss fen, 2008, 10,500 ft, 2296; inlet of Frozen Lake, seepage slope, 2008, 10,550 ft, 2570 (MHA, MO, S), det. L. Hedenäs; head of Wyoming Creek, alpine Bryidae fen, 2009, 10,600 ft, 4968. **Black Pyramid Mountain:** summits: alpine fen, 2008, 10,100 ft, 2491; WY-MT state line: unnamed lake, *Salix* sp./*Carex* spp. (+ Bryidae mosses) fen, 2010, 9750 ft, 8051.

Note: A rare species of mountain and arctic fens, occurring in mineral-rich to strongly calcareous habitats. In North America, it is known from few locations, including those from Medicine Bow Mts. of south-eastern Wyoming, collected by F.J. Hermann in 1962 (L. Hedenäs, Swedish Museum of Natural History, Stockholm, personal communication).

**** Pseudocalliergon turgescens** (T.Jensen) Loeske

[*Scorpidium turgescens* (T.Jensen) Loeske]

First record: 1973. Sporadic; on moist boggy soil in calcareous fens at alpine elevations; arctic-alpine.

Deep Lake: [Hwy 212], alpine bogs of E summit, head of Wyoming Creek, 1973, 3250 m.s.m., *Weber B-44257* (COLO); summits: alpine fen-1, 2008, 10,500 ft, 2302, assoc.: *Scorpidium cossonii*; Wyoming Creek-2, 2009, 10,600 ft, 4951 (COLO). **Black Pyramid Mountain:** summits: alpine fen-3, on soaked peaty soil, assoc.: *Pseudocalliergon angustifolium*, 2008, 10,100 ft, 2491A.

Note: A species rare in North America (particularly, south of the Canadian border); listed as a species of

conservation concern in Montana (Elliott and Pipp 2019).

*** Pseudoleskea incurvata** (Hedw.) Loeske

[*Lescuraea incurvata* (Hedw.) E.Lawton]

First record: 1953. Sporadic; on granite boulders, especially in or near streamlets in upper subalpine and alpine.

Beartooth Butte: Little Bear Creek-1, 2008, 9700 ft, 2690. **Deep Lake:** summits: alpine tundra-6, 2008, 10,850 ft, 3376 (ASC), det. J. Spence. **Unclear location:** [Hwy 212], 1953, 10,000 ft, *Whitehouse 27477* (WTU).

Pseudoleskea radicata (Mitt.) Macoun & Kindb.

[*Lescuraea radicata* (Mitt.) Mönk.]

First record: 1953. Common; on rocks outcrops and debris scattered across forests, meadows and tundra, from montane through the alpine.

Muddy Creek: Beartooth Creek-3, 2010, 7550 ft, 7414. **Beartooth Butte:** 2 mi W of Beartooth Lake, 1953, *Whitehouse s.n.* (WTU); Beartooth Butte, Beartooth Creek near Beartooth Lodge, 1953, *Lawton 1946* (WTU); near stream at Beartooth Lodge, 1953, *Lawton 1944* (WTU); Beartooth Lake, across the Lake from the Lodge, *Lawton 2075* (WTU); Meadow Lake Fen, 2008, 9850 ft, 3772; Beartooth Falls, 2009, 8900 ft, 5446; Little Bear Creek-4, 2009, 8950 ft, 6226; Beartooth Lake: SW shore, 2010, 8900 ft, 6633; Little Bear Lake: SE shore, 2010, 9650 ft, 8317. **Deep Lake:** Wyoming Creek-2, 2009, 10,500 ft, 5015; Sawtooth Lake, 2009, 9250 ft, 6025; Lower Top Lake Fen, 2010, 9450 ft, 7683.

Pseudoleskeella rupestris (Berggr.) Hedenäs & L.Söderstr.

[*Leskea rupestris* Berggr.]

First record: 2008. Rare, single collection from alpine elevation.

Black Pyramid Mountain: summits: alpine fen-3, on calcareous rocks, 2008, ! 10,100 ft (3080 m), 2508.

Note: Altitudinal update – 3080 m vs. “low to high elevations (0–3000 m)” (FNA 2014, p. 364).

Pterigynandrum filiforme Hedw.

First record: 2010. Rare, at montane elevations.

Jim Smith Peak: Crazy Creek-2, rocky bank, wet *Picea glauca* (+*Pinus contorta* var. *latifolia*)/*Alnus* sp. forest, on shaded granite outcrops in splash zone of creek, 2010, 6900 ft, 7968. **Muddy Creek:** Lake Creek-2, rocky bank, on wet surface of granite outcrop, in splash zone, shaded by spruce, 2016, 6900–6950 ft, 21036.

Ptilium crista-castrensis (Hedw.) DeNot.

First record: 1953. Rare, both collections from Crazy Creek, in montane zone.

Jim Smith Peak: W of Beartooth Butte, Crazy Creek CG, along Crazy Creek, 1953, *Lawton 2018* (WTU); Crazy Creek, swampy *Picea glauca* x *P. engelmannii* + *Pinus* spp. forest, at the base of spruce and pine, on shaded humus soil and litter, 2008, ! 7000 ft (2130 m), 3179.

Note: Altitudinal update – 2130 m vs. “low to high elevations (0–2000 m)” (FNA 2014, p. 563).

Ptychostomum creberrimum (Taylor) J.R.Spence & H.P.Ramsay

[*Bryum creberrimum* Taylor; *B. lisae* var. *cuspidatum* (Bruch & Schimp.) Margad.]

First record: 2008. Sporadic; on damp and dry soil and soil over rocks, from montane through the alpine.

Jim Smith Peak: Crazy Creek CG, 2008, 7000 ft, 3207; Crazy Creek-2, 2010, 6900 ft, 7988 (ASC), det. J. Spence. **Beartooth Butte:** Little Bear Creek-2, 2008, 9500 ft, 3259 (ASC), det. J. Spence. **Deep Lake:** dry creek in alpine tundra, 2008, 10,350 ft, 2432, S+; inlet of Frozen Lake, 2008, 10,500 ft, 2595 (ASC), det. J. Spence.

Ptychostomum cyclophyllum (Schwägr.) J.R.Spence

[*Bryum cyclophyllum* (Schwägr.) Bruch & Schimp.]

First record: 1965. Sporadic; on wet soil in subalpine and alpine wetlands, fens and moist tundra; essentially arctic-alpine.

Beartooth Butte: Beartooth Falls, 2009, 8900 ft, 5436.

Deep Lake: alpine tundra, 1965, 10,000 ft, *Hermann 20070* (RM, WTU); summits: alpine fen-2, 2008, 10,800 ft (3290 m), 2336; inlet of Frozen Lake, 2008, 10,350 ft, 2601; summits: small alpine lake, 2008, 10,500 ft, 3499.

Note: Altitudinal update – 3290 m vs. “low to high elevations (0–3000 m)” (FNA 2014, p. 171).

Ptychostomum inclinatum (Sw. ex Brid.) J.R.Spence

[*Bryum amblyodon* Müll.Hal.]

First record: 1953. Sporadic; in subalpine wetlands and alpine tundra, on rocky ridgcrests and slopes, stabilized talus; arctic-alpine.

Deep Lake: [Hwy 212], along a stream just W of the summit, 1953, 2750–3050 m, *Lawton 1993* (WTU); dry creek in alpine tundra, 2008, 10,350 ft, 2436, S+; inlet of Frozen Lake, seepage slope, 2008, 10,350–10,550 ft, 2549 (ASC), det. J. Spence, S+; summits: alpine tundra-11, 2010, 10,750 ft, 8161 (ASC), det. J. Spence. **Black Pyramid Mountain:** summits: alpine tundra-4, 2008, 10,200–10,300 ft, 2479 (ASC), det. J. Spence.

**** Ptychostomum knowltonii** (Barnes) J.R.Spence

[*Bryum knowltonii* Barnes]

First record: 2008. Sporadic; on soil in moist alpine tundra, zone of late snow-melt; essentially arctic-alpine.

Deep Lake: summits: dry creek in alpine tundra, 2008, 10,350 ft, 2430 (ASC), det. J. Spence; Gravel Pit vicinity, alpine tundra, 2010, 10,400 ft, 7271.

Black Pyramid Mountain: summits: alpine fen-3, 2008, 10,100 ft, 2489 (ASC), det. J. Spence.

Note: A rarely collected species, with very few known occurrences in Wyoming (Kosovich-Anderson unpublished data).

Ptychostomum pallescens (Schleich. ex Schwägr.) J.R.Spence

[*Bryum pallescens* Schleich. ex Schwägr.]

First record: 1953. Frequent; on wet soils of different origin, often along streams, also in crevices in rocks, on rotting logs, trunks and duff in forests, on loamy soil in *Artemisia tridentata* thickets, from montane through the alpine.

Jim Smith Peak: Ivy Lake: SE edge, 2010, 8000 ft, 7566. **Muddy Creek:** seepage slope along Hwy 212, 2009, 8700 ft, 6105, S+; SE slope: sagebrush thickets, 2010, 7750 ft, 7405; Rd 801: swampy mixed forest, 2009, 7000 ft, 6168; top of terrace: sagebrush thickets, 2010, 7650 ft, 7198. **Beartooth Butte:** Clay Butte foothills: subalpine forest, 2009, 9000 ft, 5390, S+; Fantan Lake: N shore, 2010, 9500 ft, 7042. **Deep Lake:** Hwy 212, 13 mi E of Beartooth Lake, 1953, 10,500 ft, *Conard s.n.* (NY), det. A.L. Andrews.

Ptychostomum pseudotriquetrum (Hedw.) J.R.Spence & H.P.Ramsay ex Holyoak & N.Pedersen

[*Bryum pseudotriquetrum* (Hedw.) P.Gaertn., B.Mey. & Scherb.]

First record: 1953. Common; on boggy soil in riparian willow communities and willow carrs, eutrophic fens, along streamlets, lakes and ponds (often on carbonate soils), in seepage areas in coniferous forests; from foothills through the alpine.

Jim Smith Peak: Little Moose Peatland, 2002, 7960 ft, *Jackson s.n.* (RM), det. YKA. **Muddy Creek:** [Hwy 296], along Lake Creek, near Beartooth Butte, 1953, *Lawton 2099* (WTU); drainage pipe beside Hwy 212, 2009, 8300 ft, 6110; Ghost Creek Fen, 2008, 7900 ft, 3748; Muddy Creek-1, 2009, 8100 ft, 6129, S+; Hwy 212 and Rd 188 intersection: boggy valley, 2010, 7550 ft, 7208. **Beartooth Butte:** W end of Beartooth Lake, 1953, *Lawton 1957* (WTU); Beartooth Butte-1, 2009, 8950 ft, 5297. **Deep Lake:** [Hwy 212], W side, under late snow patch, rills and snowbeds, 1973, 3200 m.s.m., *Weber B-44305* (COLO, RM); alpine bogs, head of Wyoming Creek, 1973, 3250 m.s.m., *Weber B-44224* (COLO, RM), det. J. Spence; summits: alpine fen-1, 2008, 10,500 ft, 2307; summits: alpine fen-2, 2008, 10,850 ft, 2323 (ASC), det. J. Spence; inlet of Frozen Lake, seepage slope, 2008, 10,350 ft, 2550 (ASC), ver. J. Spence; Wyoming Creek-2, head of creek, 2009, 10,600 ft, 4980; summits: snow-melt rill, 2010, 10,600 ft, 6726; Gravel Pit vicinity, zone of late snowmelt, 2010, 10,400 ft, 7272. **Black Pyramid Mountain:** summits: alpine tundra-4, 2008, 10,200–10,300 ft, 2477 (ASC), ver. J. Spence; summits: alpine fen-3, 2008, 10,100 ft, 2489; WY-MT state line: unnamed lake, 2010, 9750 ft, 8056.

*** Ptychostomum schleicheri** (DC.) J.R.Spence

[*Bryum schleicheri* DC.]

First record: 2008. Rare, at subalpine elevations; arctic-alpine.

Beartooth Butte: Island Lake CG: subalpine meadow, on shaded soil, between granite outcrops, 2008, 9500 ft, 2924 (DUKE), det. J. Shaw; Long Lake: E shore, on peaty banks of lake, 2010, 9600 ft, 6814.

Ptychostomum turbinatum (Hedw.) J.R.Spence[*Bryum turbinatum* (Hedw.) Turner]

First record: 1953. Frequent; on wet soil in forests, on peaty soil along lakes, on stream banks in tundra communities, at subalpine and alpine elevations.

Beartooth Butte: SE and E of Beartooth Lodge cabins, 1953, *Welch 15867* (WTU), S+; base of Beartooth Butte, 1953, *Lawton 2064* (WTU); S slope of Beartooth Butte, 1953, *Lawton 2055 & 2063* (WTU); Beartooth Butte-1, 2009, 8950–9250 ft, 5252 (ASC), det. J. Spence. **Deep Lake:** Beartooth Pass, 38 mi NW Cody, edge of streamlet, 1965, 10,000 ft, *Hermann 20070* (WTU). **Black Pyramid Mountain:** WY-MT state line: unnamed lake, 2010, 9800 ft, 8057 (ASC), det. J. Spence.

Ptychostomum weigeli (Biehler) J.R.Spence[*Bryum weigeli* Biehler]

First record: 2008. Frequent; on wet boggy soil in minerotrophic fens, snow-melt rills and seepage slopes, at all elevations.

Jim Smith Peak: Crazy Creek CG Swamp, 2008, 6950 ft, 3181. **Beartooth Butte:** Meadow Lake Fen, 2008, 9850 ft, 3823; boggy valley NE of Fantan Lake, 2010, 9500 ft, 6830; Fantan Lake: N shore, 2010, 9500 ft, 7029. **Deep Lake:** summits: alpine fen-2, seepage zone, 2008, 10,850 ft, 2325, det. J. Spence; ski-lift scenic point, wet alpine tundra, 2008, 10,900 ft, 2354; Canyon Creek, 2009, 9400 ft, 5671; head of unnamed creek-1, 2010, 10,250 ft, 6735; Dollar Lake: SW shore, 2010, 9400 ft, 7760. **Black Pyramid Mountain:** WY-MT state line: unnamed lake, 2010, 9800 ft, 8097.

* ** **Rhizomnium andrewsianum** (Steere) T.J.Kop.[*Mnium andrewsianum* Steere]

First record: 1973. Rare, single collection from upper subalpine zone; arctic or arctic-alpine.

Beartooth Butte: [Hwy 212], swales around small lakes, subalpine zone between Long Lake and lower Shepherder Lakes, 1973, ! 2900 m.s.m. (2900 m), *Weber B-44267* (RM -, COLO), det. P. Eckel: “small leaves, subalpine”. Specimen not seen.

Note: A rare species of essentially high arctic distribution. The only known station in Wyoming is on the Beartooth Plateau. Altitudinal update – 2900 m vs. “low elevations [0–199 m]” (FNA 2014, p. 238).

Rhizomnium magnifolium (Horik.) T.J.Kop.[*Mnium magnifolium* Horik.]

First record: 2008. Frequent; on soaked soil and duff in seepage areas in coniferous forests and swamps, from montane through the alpine; essentially arctic-alpine.

Jim Smith Peak: Crazy Creek CG Swamp, 2008, 6950 ft, 3190 (H, MO), det. T. Koponen. **Muddy Creek:** tributary of Beartooth Creek-1, 2010, 8450 ft, 7102; Beartooth Creek-3, 2010, 7550 ft, 7439. **Beartooth Butte:** boggy shore of Island Lake, 2008, 9500 ft, 2390; Chain Lake: S shore, 2010, 9500 ft, 6990; Fantan Lake: N shore, 2010, 9550 ft, 7022 (H,

MO), det. T. Koponen; Little Bear Lake: SE shore, 2010, 9650 ft, 8316 (H, MO), det. T. Koponen. **Deep Lake:** Sawtooth Lake, 2009, 9250 ft, 6062; small alpine lake along Hwy 212, 2010, ! 10,000 ft (3050 m), 8256.

Note: Altitudinal update – 3050 m vs. “low to moderate elevations [0–1599 m]” (FNA 2014, p. 240).

Rhizomnium pseudopunctatum (Bruch & Schimp.)

T.J.Kop.

[*Mnium pseudopunctatum* Bruch & Schimp.]

First record: 1973. Common; on wet soil and duff in boggy forests and minerotrophic fens, from montane through the subalpine; arctic-alpine and subarctic.

Jim Smith Peak: Crazy Creek CG Swamp, 2008, 6950 ft, 3169. **Muddy Creek:** Lily Lake Swamp Forest, 2008, 7750 ft, 3024; Lily Lake Fen, 2008, 7750 ft, 3089; Ghost Creek Fen, 2008, 7900 ft, 3740.

Beartooth Butte: [Hwy 212], between Long Lake and lower Shepherd Lakes, subalpine zone, 1973, 2900 m.s.m., *Weber s. n.* (TENN); Little Bear Creek-1, 2008, ! 9700 ft (2960 m), 2697; Little Bear Lake Fen, 2008, 9600 ft, 2801; Beartooth Lake: E shore, 2009, 8900 ft, 4836; Little Bear Creek-3, 2009, 9400 ft, 5326; Beartooth Falls, 2009, 8900 ft, 5452. **Deep Lake:** creek connecting Dollar and Sawtooth Lakes, 2009, 9400 ft, 5786; Sawtooth Lake, 2009, 9300 ft, 6031.

Note: Altitudinal update – 2960 m vs. “low to moderate elevations [0–1599 m]” (FNA 2014, p. 242).

Rhizomnium punctatum (Hedw.) T.J.Kop.[*Mnium punctatum* Hedw.]

First record: 2008. Rare, single collection from subalpine elevations.

Beartooth Butte: *Pinus contorta* var. *latifolia* forest along Hwy 212, brook bank, moist clayey soil, assoc.: *Chiloscyphus pallescens*, 2008, ! 8950 ft (2730 m), 3905.

Note: Altitudinal update – 2730 m vs. “low to moderate elevations [0–1599 m]” (FNA 2014, p. 242).

Rhytidium rugosum (Hedw.) Kindb.

First record: 1953. Frequent; on soil in alpine tundra.

Beartooth Butte: between Beartooth Lake and summit, on soil below rock, 1954 [?], 10,600 ft, *Welch 16629* (WTU). **Deep Lake:** [Hwy 212], near summit, 1953, 10,940 ft, *Lawton 1981* (WTU); summits: alpine fen-1, 2008, 10,500 ft, 2301; summits: alpine tundra-3, 2008, 10,350 ft, 2405; summits: dry creek in alpine tundra, 2008, 10,350 ft, 2447; summits: alpine tundra-7, 2010, 10,800 ft, 6719; Gravel Pit vicinity, alpine tundra, 2010, 10,400 ft, 7320; summits: alpine tundra-9, 2010, 10,400 ft, 8119. **Black Pyramid Mountain:** summits: alpine tundra-4, 2008, 10,200–10,300 ft, 2464.

Rosulabryum capillare (Hedw.) J.R.Spence[*Bryum capillare* Hedw.]

First record: 1953. Sporadic; on soil banks and rotten wood, from montane through the alpine.

Jim Smith Peak: Crazy Creek-2, 2010, 6900 ft, 7972. **Deep Lake:** 9 mi E of Beartooth Lake, 1953, 10,450

ft, *Conard s.n.* (NY); inlet of Frozen Lake, 2008, ! 10,350 ft (3150 m), 2592.

Note: Altitudinal update – 3150 m vs. “low to high elevations (0–2500 m)” (FNA 2014, p. 182).

* **Rosulabryum elegans** (Nees ex Brid.) Ochyra
[*Bryum elegans* Nees ex Brid.]

First record: 2008. Frequent: mostly calciphile moss, on wet soil of creek banks, in alpine fens and tundra, from subalpine through alpine elevations.

Beartooth Butte: Little Bear Creek-3, 2009, 9400 ft, 5346, det. J. Spence. **Deep Lake:** summits: alpine tundra-3, 2008, 10,350 ft, 2398; dry creek in alpine tundra, 2008, 10,350 ft, 2429; summits: alpine tundra-6, 2008, 10,850 ft, 3338 (ASC), det. J. Spence.

Black Pyramid Mountain: summits: alpine tundra-4, 2008, 10,200–10,300 ft, 2472; summits: alpine fen-3, 2008, 10,100 ft, 2504 (ASC), det. J. Spence.

Note: Collections from the Beartooth Plateau are represented by “*stirtonii*” expression (J. Spence personal communication).

Rosulabryum laevifilum (Syed) Ochyra
[*Bryum laevifilum* Syed]

First record: 2008. Rare, at montane through alpine elevations.

Muddy Creek: Lake Creek CG: spruce forest, on granite boulder, 2009, 6950 ft, 5918. **Deep Lake:** summits: granite outcrop in alpine tundra, on rock, 2008, ! 10,900 ft (3320 m), 2538, gemm.

Note: Altitudinal update – 3320 m vs. “low to high elevations (0–2500 m)” (FNA 2014, p. 183).

* **Saelania glaucescens** (Hedw.) Broth.

First record: 1953. Rare, at foothills and montane elevations, both collections from Crazy Creek.

Jim Smith Peak: W of Beartooth Butte, Crazy Creek CG, 1953, *Lawton 2020* (WTU); Crazy Creek-2, on soil at base of granite rocks, 2010, 6900 ft, 7945.

* ** **Sanionia nivalis** Hedenäs

First record: 2008. Frequent; on soil at late snow-melt areas, alpine and upper subalpine fens and meadows; arctic-alpine.

Deep Lake: summits: alpine fen-1, 2008, 10,500 ft, 2313, S+; inlet of Frozen Lake, 2008, 10,550 ft, 2557; summits: alpine fen-4, 2008, 10,400 ft, 3268; summits: wet alpine meadow, 2008, 10,750 ft, 3397; summits: alpine fen-5, 2008, 10,750 ft, 3430 (COLO, MO, S), S+; Littlerock Creek Fen, 2008, 10,650 ft, 3558, S+; Wyoming Creek-2, 2009, 10,450–10,600 ft, 4964; Sawtooth Palsa Fen, 2009, 9700 ft, 5752, S+. **Black Pyramid Mountain:** summits: alpine fen-3, 2008, 10,100 ft, 2500.

Note: A recently described rare arctic-alpine species, found in mountains in the high- and middle-alpine regions, and in the arctic, in late snowbeds and on the shores of glacier-fed brooks. In the author’s experience, reliable identification of species is possible only if mature capsules present. So far, the Beartooth occurrences of the species are the only known in Wyoming (Kosovich-Anderson and Weber 2011, Kosovich-Anderson unpublished data).

Sanionia uncinata (Hedw.) Loeske

[*Drepanocladus uncinatus* (Hedw.) Warnst.]

First record: 1953. Common; on tree and shrub bases and along stream banks in forests, swamps and meadows, riparian willow communities, on soil over rocks, logs, stumps, decorticated downed wood, from foothills to the alpine.

Muddy Creek: Lily Lake Fen, 2008, 7750 ft, 3093; Ghost Creek Fen, 2008, 7900 ft, 3685; Lake Creek Waterfalls, 2009, 7500 ft, 5824; Muddy Creek-2, 2010, 7750 ft, 7226. **Beartooth Butte:** Beartooth Lodge, near stream, 1953, *Lawton 1930* (WTU); [Hwy 212], swales around small lakes, subalpine zone between Long Lake and lower Sheepherder Lakes, 1973, 2900 m.s.m., *Weber B-44276* (COLO, RM); Fantan North Fen (Heidel et al. 2008); Little Bear Lake Fen, 2008, 9600 ft, 2791, S+; Clay Butte Fen, 2008, 9000 ft, 2946; Meadow Lake Fen, 2008, 9850 ft, 3784; Beartooth Falls, 2009, 8900 ft, 5436; Chain Lake: S shore, 2010, 9500 ft, 7003. **Deep Lake:** Littlerock Creek Fen and Sawtooth Palsa Fen (Heidel et al. 2008); summits: alpine fen-1, 2008, 10,500 ft, 2294; Canyon Creek, 2009, 9400 ft, 5682; W summit and vicinity, 2010, 11,050 ft, 6678; Long Lake, NW slope: willow wetlands, 2010, 9750 ft, 8294. **Black Pyramid Mountain:** WY-MT state line: unnamed lake, 2010, 9800 ft, 8092.

Sarmentypnum exannulatum (Schimp.) Hedenäs

[*Drepanocladus exannulatus* (Schimp.) Warnst., *Warnstorfia exannulata* (Schimp.) Loeske]

First record: 1953. Common; in swales of fens, bog pools, ponds and along edges of lakes, around springs or snowbeds, in mossy wet gravelly tundra; from foothills through the alpine.

Jim Smith Peak: Rock Creek Fen (Heidel et al. 2008). **Muddy Creek:** East Lily Peatland, 2002, 8100 ft, *Jackson s.n.*, det. YKA; Mud Lake Fen, 2008, 7750 ft, 3113; Ghost Creek Fen, 2008, 7900 ft, 3702.

Beartooth Butte: Near Beartooth Lake cabins, in water in coniferous forest, 1953, *Welch 16577* (WTU); [Hwy 212], swales around small lakes, subalpine zone between Long Lake and lower Sheepherder Lakes, 1973, 2900 m.s.m., *Weber B-44252* (COLO, RM), det. J. Janssens as *Drepanocladus exannulatus* var. *rotae* (DeNot.) Loeske; Lower Sheepherder Fen and Meadow Lake Fen (Heidel et al. 2008); Little Bear Lake Fen, 2008, 9600 ft, 2846; Little Bear Creek-2, 2008, 9500 ft, 3233; Beauty Lake Trail, 2009, 8900 ft, 5319. **Deep Lake:** [Hwy 212], E of the summit, near small glacial lake, 1953, 10,500 ft, *Lawton 1971* (WTU); [Hwy 212], along a stream W of the summit, 1953, *Lawton 1992* (WTU); W side of Beartooth Pass, rills and snowbeds, 1973, 3200 m.s.m., *Weber B-44310* (COLO, RM); S of Sawtooth Mt., wet boggy area surrounding palsa peatbed, 2007, 9800 ft, *E.Elliott, Heidel & B.Elliott 3587* (RM), det. YKA; ca. 2 air mi ENE of Beartooth Pass, wet alpine meadows, 2008, approx. 10,600–10,800 ft, *Elliott 14629a* (RM), det. YKA, S+; 3 mi E of Beartooth Pass, dry alpine meadow, 2008, approx.

10,600–10,800 ft, *Elliott 14660* (RM), det. YKA; Wyoming Creek and upstream, 2008, 10,300–10,550 ft, *Hartman 87943* (RM), det. YKA; Lake WGN Fen and Sawtooth Palsa Fen (Heidel et al. 2008); summits: alpine fen-1, 2008, 10,500 ft, 2306 (S, MO), det. L. Hedenäs; summits: wet alpine meadow, 2008, 10,750 ft, 3397; summits: alpine fen-5, 2008, 10,750 ft, 3405; Littlerock Creek Fen, 2008, 10,650 ft, 3548; summits: snow-melt rill, 2010, 10,600 ft, 6726. **Black Pyramid Mountain:** WY-MT state line: unnamed lake, 2010, 9750 ft, 8053.

Note: Some submerged alpine forms have longly excurrent costa, with leaf morphology strongly suggesting Arctic *Sarmentypnum trichophyllum* (Warnst.) Hedenäs. Comparison of these collections with Swedish material of *S. trichophyllum* kindly provided by Lars Hedenäs shows that in the study area occur phenotypes of *S. exannulatum* with clearly excurrent costae.

Sarmentypnum sarmentosum (Wahlenb.) Tuom. & T.J.Kop.

[*Calliergon sarmentosum* (Wahlenb.) Kindb., *Warnstorfia sarmentosa* (Wahlenb.) Hedenäs]

First record: 1973. Common; in swales of mineral-rich alpine fens, in frost scar pools, often around springs in late snowbeds, at upper subalpine and alpine elevations; arctic-alpine.

Beartooth Butte: Little Bear Lake Fen, 2008, 9600 ft, 2845 (CAS, COLO); Meadow Lake Fen, 2008, 9850 ft, 3798; Long Lake: E shore, 2010, 9650 ft, 6802.

Deep Lake: [Hwy 212], alpine bogs, head of Wyoming Creek, 1973, 3250 m.s.m., *Weber B-44254* (COLO, RM); just off Hwy 212, alpine fen, 2007, 10,700 ft, *E.Elliott* (with *Houston & B. Elliott*) 3659 (RM), det. YKA; Littlerock Creek Fen (Heidel et al. 2008); summits: alpine fen-1, 2008, 10,500 ft, 2295; inlet of Frozen Lake, 2008, 10,500 ft, 2548; summits: alpine fen-5, 2008, 10,750 ft, 3427; Wyoming Creek-2, 2009, 10,600 ft, 4962; head of unnamed creek-1, 2010, 10,250 ft, 6746; Gravel Pit vicinity, small alpine lake, 2010, 10,400 ft, 7301; creek connecting Lower Top and Sawtooth Lakes, 2010, 9450 ft, 7625. **Black Pyramid Mountain:** WY-MT state line: unnamed lake, 2010, 9750 ft, 8083A.

Schistidium agassizii Sull. & Lesq.

First record: 1953. Sporadic; on wet rocks along streams, from foothills through the montane, essentially arctic-alpine.

Jim Smith Peak: W of Beartooth Butte, Crazy Creek CG, 1953, *Lawton 2028* (WTU); Crazy Creek-2, 2010, 6900 ft, 7941. **Muddy Creek:** W of Beartooth, [Hwy 296], at Lake Creek, 1953, *Lawton 2046* (WTU); Gilbert Creek-2, 2010, 6900 ft, 8011.

* **Schistidium apocarpum** (Hedw.) Bruch & Schimp.

First record: 1953. Sporadic; on wet granite cliffs and ledges, from montane through the alpine.

Jim Smith Peak: W of Beartooth Butte, Crazy Creek CG, 1953, *Lawton 2032* (WTU). **Muddy Creek:** Lake Creek CG, wet spruce forest, 2009, 6950 ft, 5912.

Deep Lake: [Hwy 212], near summit, 1953, ! 11,000 ft (3350 m), *Lawton 1982* (WTU). **Unclear location:** granite bluff along [Hwy 212], 46 miles NW of Cody, 1965, 7550 ft, *Hermann 20063* (RM).

Note: Altitudinal update – 3350 m vs. “low to moderate elevations (0–1500 m)” (FNA 2007, p. 211).

* **Schistidium atrichum** (Müll.Hal. & Kindb.) W.A.Weber

First record: 2008. Rare, single collection from upper subalpine zone. E.

Beartooth Butte: Island Lake CG, *Picea engelmannii* forest, on rock debris in shade of spruce, 2008, 9500 ft, 2219, det. M. Ignatov, S+.

Schistidium confertum (Funck) Bruch & Schimp.

First record: 2008. Rare, single collection from subalpine zone.

Beartooth Butte: Hwy 212, S-facing slope, *Pinus contorta* forest, on rock, 2008, 9000 ft, 3882, S+.

Schistidium dupretii (Thér.) W.A.Weber

First record: 1953. Rare, single collection, elevation unknown.

Beartooth Butte: S slope of Beartooth Butte, 1953, *Lawton 2058* (WTU).

* **Schistidium papillosum** Culm.

First record: 1953. Sporadic; on shaded rocks and cliffs along streams in forested areas, from foothills through the subalpine.

Jim Smith Peak: Crazy Creek-2, 2010, 6900 ft, 7973, S+. **Beartooth Butte:** Island Lake CG, spruce forest, 2008, ! 9500 ft (2900 m), 2224, S+. **Unclear location:** W of Beartooth, Clarks Fork of Yellowstone River, 1953, *Lawton 1998a* (WTU), det. H.H. Blom.

Note: Altitudinal update – 2900 m vs. “low to high elevations (0–2000 m)” (FNA 2007, p. 221).

Schistidium rivulare (Brid.) Podp.

First record: 1953. Sporadic; on wet granite rocks along streams from foothills to alpine zone.

Jim Smith Peak: W of Beartooth Butte, Crazy Creek CG, 1953, *Lawton 2024* (WTU). **Muddy Creek:** Lake Creek Waterfalls, 2009, 7500 ft, 5856; Lake Creek-1, 2010, 7700 ft, 7140, S+; Muddy Creek-2, 2010, 7750 ft, 7248. **Deep Lake:** Gravel Pit vicinity, alpine tundra, 2010, 10,400 ft, 7311.

** **Sciuro-hypnum glaciale** (Schimp.) Ignatov & Huttunen

[*Brachythecium glaciale* Schimp.]

First record: 2008. Rare, at alpine elevations; arctic-alpine.

Deep Lake: Wyoming Creek-1, on wet silt along streams, 2008, 10,300 ft, 3469; summits: small alpine lake, boggy shore, on wet clay, assoc.: *Polytrichastrum alpinum* s.l., 2008, 10,500 ft, 3508 (MHA, MO), det. M. Ignatov.

Note: A highly disjunct species, reported from the Wyoming's Beartooth Plateau as new to North American continent (Kosovich-Anderson and Ignatov 2010).

Sciuro-hypnum latifolium (Kindb.) Ignatov & Huttunen

[*Brachythecium nelsonii* Grout, *B. latifolium* Kindb.]

First record: 1953. Common; seepage areas in coniferous forests, riparian willow communities, in subalpine and alpine fens and peaty and rocky banks of streams, in wet tundra, snow-melt rills.

Muddy Creek: Lily Lake Swamp Forest, 2008, 7750 ft, 3034; tributary of Beartooth Creek-1, 2010, 8450 ft, 7062; Beartooth Creek-3, 2010, 7550 ft, 7439; Ghost Creek, 2010, 7900 ft, 8428. **Beartooth Butte:** Beartooth Lodge, near stream, 1953, *Lawton 1925* (WTU); Island Lake CG: subalpine meadow, 2008, 9500 ft, 2913; Meadow Lake Fen, 2008, 9850 ft, 3817; Beauty Lake Trail, 2009, 8900 ft, 5223; Beartooth Falls, 2009, 8900 ft, 5463; Little Bear Creek-4, 2009, 8950 ft, 6222 (MHA, MO), det. M. Ignatov. **Deep Lake:** Sawtooth Palsa Fen (Heidel et al. 2008); inlet of Frozen Lake, 2008, 10,350 ft, 2571; Wyoming Creek-1, 2008, 10,300 ft, 3477; Canyon Creek, 2009, 9400 ft, 5645; summits: snow-melt rill, 2010, 10,600 ft, 6724.

Sciuro-hypnum oedipodium (Mitt.) Ignatov & Huttunen

[*Brachythecium oedipodium* (Mitt.) A.Jaeger]

First record: 1973. Frequent; in forests on duff, rotten wood, humus, mineral soil, on rocks, from montane through the alpine.

Muddy Creek: Ghost Creek Fen, 2008, 7900 ft, 3759 (MHA, MO), det. M. Ignatov; Rd 188: sparsely forested slope, 2010, 7600 ft, 7186. **Beartooth Butte:** Island Lake CG, spruce forest, 2008, 9500 ft, 2217 (½) (MHA, MO), det. M. Ignatov; Beartooth Lake CG: spruce forest, 2009, 8950 ft, 6207; 4WD Rd 149-1A: forested SW slope, 2010, 9650 ft, 7006 (MHA, MO), det. M. Ignatov. **Deep Lake:** [Hwy 212], W side of Beartooth Pass, rills and snowbeds, 1973, 3200 m.s.m., *Weber B-44307* (COLO, RM, US).

Sciuro-hypnum plumosum (Hedw.) Ignatov & Huttunen

[*Brachythecium plumosum* (Hedw.) Schimp.]

First record: 2009. Sporadic; on rocks and soil along streams, in montane zone.

Muddy Creek: Lake Creek Waterfalls, 2009, 7500 ft, 5832 (MHA, MO); Lake Creek CG: wet coniferous forest, 2009, 6950 ft, 5906 (MHA, MO); Muddy Creek-1, 2009, 8100 ft, 6129 (MHA, MO). All det. M. Ignatov.

* **Scorpidium cossonii** (Schimp.) Hedenäs

[*Drepanocladus intermedius* (Lindb.) Warnst., *Limprichtia cossonii* (Schimp.) L.E.Anderson, H.A.Crum & W.R.Buck]

First record: 2002. Frequent; in rich minerotrophic fens, in springs, periodically water-filled depressions, from montane through the alpine; essentially arctic-alpine.

Jim Smith Peak: Little Moose Peatland, 2002, 7960 ft, *Jackson s.n.* (RM), det. YKA. **Muddy Creek:** ca. 1 air mi W of Lily Lake, floating bog, 2007, 7750 ft,

E.Elliott & B.Elliott 574 (RM); Ghost Creek Fen and Lily Lake East Fen (Heidel et al. 2008); Mud Lake Fen, 2008, 7750 ft, 3102 (CAS). **Beartooth Butte:** Clay Butte Fen (Heidel et al. 2008); Little Bear Lake Fen, 2008, 9600 ft, 2778. **Deep Lake:** summits: alpine fen-1, 2008, 10,500 ft, 2302. **Black Pyramid Mountain:** summits: alpine fen-3, 2008, 10,100 ft, 2491 (½).

Scorpidium revolvens (Sw.) Rubers

[*Drepanocladus revolvens* (Sw.) Warnst., *Limprichtia revolvens* (Sw.) Loeske]

First record: 2008. Rare, at upper subalpine and alpine elevations; essentially arctic-alpine.

Beartooth Butte: Little Bear Lake Fen, in shallow swales, 2009, 9600 ft, 5638. **Deep Lake:** summits: alpine fen-4, on soaked peat around the pool, 2008, ! 10,400 ft (3170 m), 3271.

Note: This species, like the following one, is widespread in tundra pools across North America and Eurasia; disjunct in Wyoming's Rocky Mountains (Kosovich-Anderson unpublished data). Altitudinal update – 3170 m vs. “low to high elevations (0–3100 m)” (FNA 2014, p. 388).

Scorpidium scorpioides (Hedw.) Limpr.

First record: 2008. Rare, single collection from alpine zone.

Deep Lake: summits: alpine fen-5, in seasonal pool, highly minerotrophic, 2008, 10,750 ft, 3433 (½), forms admixture with *Sarmentypnum sarmentosum*.

Scouleria aquatica Hook.

First record: 1953. Frequent; in aquatic habitats, banks or beds of streams, on irrigated granite rocks, from montane through the subalpine.

Jim Smith Peak: W of Beartooth Butte, along Crazy Creek, 1953, *Lawton 2026* (WTU), ver. S.P. Churchill; Crazy Creek, 1953, *Welch 16697* (WTU); Crazy Creek-2, 2010, 6900 ft, 7970 (CAS). **Muddy Creek:** Lake Creek Waterfalls, 2009, 7500 ft, 5816; Muddy Creek-2, 2010, 7750 ft, 7236; Lake Creek-2, 2010, 6900 ft, 8385. **Beartooth Butte:** Beartooth Creek-1, fully submerged (!), 2009, ! 8900 ft (2710 m), 5424.

Note: Altitudinal update – 2710 m vs. “low to high elevations (0–1900 m)” (FNA 2007, p. 313).

Sphagnum angustifolium (Russow) C.E.O.Jensen

First record: 1973. Sporadic; in fens, as carpets, floating mats, low hummocks, from montane through the alpine.

Muddy Creek: East Lily Peatland, 2002, 8100 ft, *Jackson s.n.*, det. YKA; Lily Lake East Fen (Booth and Zygmunt 2005; Heidel et al. 2008). **Beartooth Butte:** [Hwy 212], swales around small lakes, subalpine zone between Long Lake and lower Shepherd Lakes, 1973, 2900 m.s.m., *Weber B-44268* (COLO, RM), det. R. Andrus. **Deep Lake:** Wyoming Creek and upstream, 2008, 10,550 ft, *Hartman 87944* (RM), det. YKA; Morrison Jeep Trail, Top Lake Fen-1, 2009, 9450 ft, 5773 (½).

* **Sphagnum fimbriatum** Wilson

First record: 1973. Sporadic; in minerotrophic fens and willow wetlands, at subalpine elevations.

Beartooth Butte: [Hwy 212], swales around small lakes, subalpine zone between Long Lake and lower Sheepherder Lakes, 1973, 2900 m.s.m., *Weber B-44287* (COLO, RM); boggy valley NE of Fantan Lake, 2010, 9500 ft, 6821. **Deep Lake:** creek connecting Dollar and Sawtooth Lakes, willow wetlands, 2009, 9400 ft, 5792.

Sphagnum fuscum (Schimp.) H.Klinggr.

First record: 2008. Rare; in alpine and subalpine fens, on peaty soil in dense hummock.

Beartooth Butte: Little Bear Lake Fen, 2008, 9600 ft, 2831. **Deep Lake:** Littlerock Creek Fen, 2008, 10,650 ft, 3631.

* ** **Sphagnum miyabeanum** Warnst.

First record: 2008. Rare to sporadic, at upper subalpine elevations.

Beartooth Butte: boggy shore of Island Lake, willow wetlands, in low hummocks, on vertical peaty banks of streamlet, also forms carpets in shallow swales, on soaked peaty soil, 2008, 9500–9600 ft, 2379, 2380, 2381, & 2392 (all in BING, DUKE); Little Bear Lake Fen, *Carex utriculata*/*Sphagnum miyabeanum* + *Sarmentypnum exannulatum* community, on soaked peaty soil, 2008, ! 9600 ft (2930 m), 2822 & 2824 (all in DUKE).

Note: A taxon of essentially oceanic habitats with Western North American – Eastern Asiatic distribution; was not included in FNA (2007). “The species has a Pacific Rim distribution that extends from California northward through British Columbia, southern Alaska, eastern Russia, southward to Japan and China” (Shaw et al. 2014, p. 19). The condition of the *S. miyabeanum* population on Little Bear Lake Fen may be characterized as vulnerable: periodic reconstruction of Hwy 212, which crosses Little Bear Lake Fen, is negatively affecting the fen ecosystem. Altitudinal update – 2930 m vs. “from sea level to moderate elevations” (Shaw et al. 2014, p. 19). Specimens 2379, 2380, 2381, 2392, 2822, and 2824 were included in genetic microsatellite analyses (Shaw et al. 2014, 2015).

Sphagnum platyphyllum (Lindb. ex Braithw.) Sull. ex Warnst.

First record: 1973. Common; in swales of fens, pools in lakeside swamps, in flooded sites, from montane through the lower alpine.

Jim Smith Peak: Rock Creek Fen (Heidel et al. 2008); Ivy Lake: SE edge, 2010, 8000 ft, 7527.

Beartooth Butte: [Hwy 212], swales around small lakes, subalpine zone between Long Lake and lower Sheepherder Lakes, 1973, 2900 m.s.m., *Weber B-44271* (COLO, RM); Lower Sheepherder Fen and Meadow Lake Fen (Heidel et al. 2008); boggy shore of Island Lake, 2008, 9500 ft, 2365; Little Bear Lake Fen, 2008, 9600 ft, 2747, 2820 & 2826 (all in DUKE), ver. J. Shaw; Meadow Lake Fen, 2008, 9800–9900 ft, 3763 (DUKE), ver. J. Shaw; Beartooth Lake: E

shore, 2009, 8900 ft, 4850 (DUKE), det. J. Shaw; boggy valley NE of Fantan Lake, 2010, 9500 ft, 6820; Fantan South Fen, 2010, 9500 ft, 6974; Long Lake: S edge, 2010, 9650 ft, 8308. **Deep Lake:** Lake WGN Fen and Sawtooth Palsa Fen (Heidel et al. 2008); Canyon Creek, 2009, 9400 ft, 5673 (DUKE), det. J. Shaw; Sawtooth Meadow, 2009, 9450 ft, 5762; Top Lake Fen-1, 2009, 9450 ft, 5779 (DUKE), det. J. Shaw; Sawtooth Lake, 2009, 9200 ft, 5968 (DUKE), det. J. Shaw; Lake WGN Fen, 2009, 9600 ft, 6076 (DUKE), det. J. Shaw; creek connecting Lower Top and Sawtooth Lakes, 2010, 9450 ft, 7597; Lower Top Lake Fen, 2010, 9450 ft, 7678; Dollar Lake: SW shore, 2010, 9400 ft, 7753.

Note: Specimens 2747, 2820, 2826, and 3763 were used in the microsatellite-based genetic analyses of the Pacific Rim clade of *Sphagnum* subgen. *Subsecunda* (Shaw et al. 2015).

* ** **Sphagnum riparium** Ångstr.

First record: 2009. Sporadic: all collections from Jeep Morrison Trail area; forms extensive carpets in weakly minerotrophic fens and on peaty banks of streams, at subalpine elevations.

Deep Lake: Canyon Creek valley, *Carex* spp./*Sphagnum riparium* + *S. russowii* + *S. squarrosum* fen, in low hummocks on soaked peaty soil, shaded by dense *Carex* stands, 2009, 9400 ft, 5657; creek connecting Lower Top and Sawtooth Lakes, all across peaty bank, 2010, 9400 ft, 7615; Lower Top Lake Fen, *Kalmia microphylla* (Hook.) A.Heller/*Carex* spp./*Sphagnum* spp. fen complex along W shore of lake, forms carpets, 2010, ! 9450 ft (2880 m), 7662.

Note: A species of arctic and boreal zones of Northern Hemisphere, distributed in northern portion of the conterminous United States; disjunct in the Wyoming mountains. Listed as a species of conservation concern in Montana (Elliott and Pipp 2019). Altitudinal update – 2880 m vs. “low to moderate elevations [0–1599 m]” (FNA 2007, p. 75).

Sphagnum russowii Warnst.

First record: 2005. Common; in willow carrs, fens and swampy forests, from montane through the alpine.

Jim Smith Peak: Rock Creek Fen (Heidel et al. 2008). **Muddy Creek:** East Lily Peatland (Booth and Zygmunt 2005); Ghost Creek Fen (Heidel et al. 2008).

Beartooth Butte: Meadow Lake Fen, Fantan North Fen, and Lower Sheepherder Fen (Heidel et al. 2008); Little Bear Lake Fen, 2008, 9600 ft, 2819.

Deep Lake: SW of Sawtooth Mt., wet meadow, 2007, approx. 9500 ft, *Elliott & Heidel 3652* (RM), det. YKA; Lake WGN Fen, Littlerock Creek Fen, and Sawtooth Palsa Fen (Heidel et al. 2008); unnamed lake S of Hwy 212, 2008, 10,000 ft, 2674 (BING, DUKE), ver. R. Andrus; Littlerock Creek Fen, 2008, 10,650 ft, 3656 (BING), det. R. Andrus; Wyoming Creek-2, 2009, 10,600 ft, 5073; Top Lake Fen-1, 2009, 9450 ft, 5778; creek connecting Dollar and Sawtooth Lakes, 2009, 9400 ft, 5786; Canyon Creek,

2009, 9400 ft, 5803; Lower Top Lake Fen, 2010, 9450 ft, 7661.

Sphagnum squarrosum Crome

First record: 2002. Frequent; on soaked boggy soil in riparian willow communities and minerotrophic fens, from montane through the subalpine.

Jim Smith Peak: Little Moose Peatland, 2002, 7960 ft, *Jackson s.n.* (RM), det. YKA. **Muddy Creek:** East Lily Peatland, 2002, 8100 ft, *Jackson s.n.* (RM), det. YKA; East Lily Peatland (Booth and Zygmunt 2005); Ghost Creek Fen, 2008, 7900 ft, 3725. **Beartooth Butte:** Meadow Lake Fen, 2008, 9850 ft, 3788; boggy valley NE of Fantan Lake, 2010, 9500 ft, 6817. **Deep Lake:** Canyon Creek, 2009, 9400 ft, 5667; creek connecting Lower Top and Sawtooth Lakes, 2010, 9450 ft, 7597.

Sphagnum teres (Schimp.) Ångstr. ex Hartm.

First record: 2002. Sporadic; on wet and soaked boggy soil in riparian willow communities and minerotrophic fens, from montane through the alpine.

Jim Smith Peak: Rock Creek Fen (Heidel et al. 2008). **Muddy Creek:** East Lily Peatland, 2002, 8100 ft, *Jackson s.n.* (RM), det. YKA; Lily Lake East Fen (Heidel et al. 2008). **Deep Lake:** Lake WGN Fen (Heidel et al. 2008); Littlerock Creek Fen, 2008, 10,650 ft, 3632.

Sphagnum warnstorffii Russow

First record: 1953. Common; forms lawns and hummocks in rich, open and forested fens, also along streams in swampy forests, from montane through the alpine.

Jim Smith Peak: Little Moose Peatlands, 2002, 7960 ft, *Jackson s.n.* (RM), det. YKA; Little Moose Lake Fen (Booth and Zygmunt 2005; Heidel et al. 2008); between Reed Lake and Rock Creek, floating bog and surrounding *Carex* mat, 2007, 7550–7800 ft, *E.Elliott, B.Elliott & Heidel 3845* (RM), det. YKA. **Muddy Creek:** East Lily Peatland, 2002, 8100 ft, *Jackson s.n.*, det. YKA; East Lily Peatland (Booth and Zygmunt 2005); between Muddy and Ghost Creeks, fen with floating mat, 2007, 6950–8100 ft, *Elliott & Heidel 3244* (RM), det. YKA; area surrounding fen with spruce overstory and stream bed, 2007, 6950–8100 ft, *Elliott & Heidel 3288* (RM), det. YKA; Ghost Creek Fen, 2008, 7900 ft, 3758 (BING), det. R. Andrus. **Beartooth Butte:** stream near Beartooth Lodge, 1953, *Lawton 1951* (WTU); [Hwy 212], swales around small lakes, subalpine zone between Long Lake and lower Sheepherder Lakes, 1973, 2900 m.s.m., *Weber B-44272* (COLO, RM, TENN); boggy shore of Island Lake, 2008, 9700 ft, 2391 (BING), det. R. Andrus; Meadow Lake Fen, 2008, 9850 ft, 3775.1 (BING), det. R. Andrus; Beauty Lake Trail, 2009, 8900 ft, 5309 (CAS, COLO). **Deep Lake:** S of Sawtooth Mt., wet boggy area surrounding palsa peatbed, 2007, 9800 ft, *E.Elliott, Heidel & B.Elliott 3586* (RM), det. YKA; Littlerock Creek Fen, 2008, ! 10,650 ft (3240 m), 3652; Wyoming

Creek-2, 2009, 10,550 ft, 5072; Canyon Creek, 2009, 9400 ft, 5802; Top Lake Fen-2, 2010, 9450 ft, 7706.

Black Pyramid Mountain: WY-MT state line: unnamed lake, 2010, 9800 ft, 8068 (DUKE).

Note: Alpine forms of the species from the Beartooth Plateau have stable morphological features: elliptic pore-like wall thinning and ruptures at the distal ends of the cells of stem hyalodermis and fibrillose hyaline cells in distal portion of stem leaves. Altitudinal update – 3240 m vs. “low to moderate elevations [0–1599 m]” (FNA 2007, p. 101).

Splachnum sphaericum Hedw.

First record: 2008. Rare, in upper subalpine and alpine zones, dung of animals on boggy soil.

Beartooth Butte: Little Bear Lake Fen, 2008, 9600 ft, 2774. **Deep Lake:** inlet of Frozen Lake, 2008, 10,350–10,550 ft, 2547.

Stegonia latifolia (Schwägr.) Venturi ex Broth.

* ** - **var. pilifera** (Brid.) Broth.

First record: 2010. Rare, single collection from alpine zone; arctic-alpine.

Deep Lake: W summit and vicinity, alpine tundra, at base of granite debris, on calcareous silt, locally abundant, 2010, ! 11,050 ft (3370 m), 6663, S+.

Note: The arctic-alpine species *Stegonia latifolia* is represented on the Beartooth Plateau with the rare variety *pilifera* with well-pronounced awn. Altitudinal update for the variety – 3370 m vs. “moderate to high elevations (600–2200 m)” (FNA 2007, p. 605).

Straminergon stramineum (Dicks. ex Brid.) Hedenäs [*Calliergon stramineum* (Dicks. ex Brid.) Kindb.]

First record: 1973. Common; in mineral-poor to mineral-rich fens, on irrigated rocks, in wet ground along the edges of tundra pools, from montane through the alpine.

Jim Smith Peak: Rock Creek Fen (Heidel et al. 2008). **Muddy Creek:** Ghost Creek Fen (Heidel et al. 2008); Mud Lake Fen, 2008, 7750 ft, 3138. **Beartooth Butte:** [Hwy 212], swales around small lakes, subalpine zone between Long Lake and lower Sheepherder Lakes, 1973, 2900 m.s.m., *Weber B-44280* (COLO, RM); Little Bear Lake Fen, 2008, 9600 ft, 2860; Clay Butte Fen, 2008, 9000 ft, 3009; boggy valley NE of Fantan Lake, 2010, 9500 ft, 6817. **Deep Lake:** S of Sawtooth Mt., palsa peatbeds, 2007, 9800 ft, *E.Elliott, Heidel, & B.Elliott 3586* (RM), det. YKA; summits: alpine fen-1, 2008, 10,500 ft, 2310; Wyoming Creek-2, 2009, 10,550 ft, 4972; Lower Top Lake Fen, 2010, 9450 ft, 7662; Dollar Lake: SW shore, 2010, 9400 ft, 7762.

* ** **Syntrichia calcicola** J.J.Amann

[*Syntrichia ruralis* var. *calcicola* (J.J.Amann) Mönk.] First record: 2009. Rare, in subalpine zone.

Muddy Creek: Clay Butte: slope facing to W, grasslands, limestone debris, in crevices of limestone rock, on a layer of loamy soil, in partial shade, assoc.: *Bryum argenteum* and *Hypnum vaucheri*, 2009, 9500 ft, 4938. **Beartooth Butte:** Beartooth Butte-1,

scattered limestone debris on E slope, in shallow crevices of rock, assoc.: *Brachytheciastrum collinum*, *Bryum argenteum*, *Distichium capillaceum*, and *Tortula obtusifolia* (Schwägr.) Mathieu, 2009, 9200 ft, 5259.

Note: Specimens from the Beartooth Plateau are morphologically almost identical to those from the Wyoming's Medicine Bow Mtns., collected by the author in 2007 (870, 1281 and others) and identified by M.T. Gallego as *Syntrichia calcicola*. A predominantly calciphilous species, known from Europe, Caucasus, and Middle Asia (Savich-Lyubitskaya and Smirnova 1970; Gallego et al. 2006). In North America, the species distribution is unclear: it was not listed in FNA (2007). The species was previously reported from Colorado by Weber and Wittmann (2007).

***Syntrichia caninervis* Mitt.**

[*Tortula caninervis* (Mitt.) Broth.]

First record: 2016. Rare (undercollected?), in montane zone.

Jim Smith Peak: Hwy 212, roadside slope, xeric grassland, on gravelly soil, 2016, 7550 ft, 21061.

* ***Syntrichia montana* Nees**

[*S. intermedia* Brid.]

First record: 2008. Sporadic; on soil over rock outcrops, from montane through the alpine.

Jim Smith Peak: Crazy Creek-2, 2010, 6900 ft, 7999.

Beartooth Butte: Beartooth Butte-1, 2009, 8950 ft, 5262. **Deep Lake:** summits: granite outcrop in alpine tundra, 2008, 10,900 ft, 2532A.

Note: Medium size plants. In Wyoming, the plants of *S. montana* are at least twice as large than they are described in FNA (2007, p. 624): "stems 2–10 mm" (Kosovich-Anderson unpublished data).

* ***Syntrichia norvegica* F.Weber**

[*Tortula norvegica* (F.Weber) Lindb.]

First record: 1973. Frequent; in forests on soil over granite outcrops, on duff and litter, on saturated ground under willows in subalpine fens and willow carrs, in late snow-melt areas in alpine tundra, from montane through the alpine; arctic-alpine.

Muddy Creek: aspen grove along Hwy 212, 2008, 7750 ft, 3919; tributary of Beartooth Creek-1, 2010, 8450 ft, 7081. **Beartooth Butte:** Island Lake CG, spruce forest, 2008, 9500 ft, 2225 (UC); pine forest along Hwy 212, 2008, 9000 ft, 3887; Little Bear Creek-3, 2009, 9400 ft, 5375; 4WD Rd 149: NE slope, subalpine meadow, 2010, 9650 ft, 7049 (MO); Beartooth Lake CG: coniferous forest, 2010, 8950 ft, 8021. **Deep Lake:** [Hwy 212], W side, rills and snowbeds, 1973, 3200 m.s.m., *Weber 44311* (COLO, RM), annot. P. Eckel; W summit and vicinity, 2010, 10,950 ft, 6665. **Black Pyramid Mountain:** WY-MT state line: unnamed lake, 2010, 9800 ft, 8097.

* ***Syntrichia papillosissima* (Copp.) Loeske**

[*Tortula ruralis* var. *hirsuta* (Venturi) Paris]

First record: 2016. Rare, in montane zone.

Jim Smith Peak: Hwy 212, roadside slope, xeric grassland, on gravelly soil, 2016, 7550 ft, 21062.

***Syntrichia ruralis* (Hedw.) F.Weber & D.Mohr**

[*Tortula ruralis* (Hedw.) P.Gaertn., B.Mey. & Scherb.]

First record: 1965. Common; on soil in sheltered areas around boulders and on ledges of rock debris and outcrops in *Festuca idahoensis* grasslands, *Artemisia tridentata* shrublands, and different types of forests – on soil, decaying wood, exposed roots of trees; on rocky ridgecrests and slopes, stabilized talus; from foothills through the alpine.

Jim Smith Peak: Crazy Creek-1, 2009, 6950 ft, 5611, S+; WY-MT state line: spruce forest, 2009, 7800 ft, 5480. **Muddy Creek:** aspen grove along Hwy 212, 2008, 7750 ft, 3918, S+; Index Lookout: roadside, 2009, 8750 ft, 6099; Lewis and Clark Trail: Douglas-fir forest, 2009, 6800 ft, 6177; top of terrace: sagebrush thickets, 2010, 7650 ft, 7202, S+; SE slope: sagebrush thickets, 2010, 7750 ft, 7407.

Beartooth Butte: Beartooth Falls, 2009, 8900 ft, 5462; granite ridge: coniferous forest, 2010, 9550 ft, 6950. **Deep Lake:** summits: alpine tundra-3, 2008, 10,350 ft, 2404; dry creek in alpine tundra, 2008, 10,350 ft, 2422 (UC); summits: granite outcrops in alpine tundra, 2008, 10,900 ft, 2539; summits: alpine tundra-6, 2008, 10,850 ft, 3342; Hwy 212: roadside granite debris, 2010, 10,200 ft, 6731; Gardner Lake: head of USFS Trail, 2010, 10,600 ft, 8189. **Black Pyramid Mountain:** summits: alpine tundra-1, 2008, 10,200–10,300 ft, 2277; summits: alpine fen-3, 2008, 10,100 ft, 2526 (CAS), ver. P. Eckel. **Unclear location:** along Rd ca. 11 mi SE of [Hwy 212], 33 mi NW of Cody, granite outcrop, 1965, *Hermann 20026* (WTU).

* ** ***Syntrichia virescens* (DeNot.) Ochyra**

First record: 2008. Rare, single collection from subalpine zone.

Beartooth Butte: Island Lake CG, *Picea engelmannii* forest, on soil in crevice of rock, 2008, 9500 ft, 2224, det. K. Kellman.

Note: The species ecology and distribution in North America are poorly known; this taxon was not included in FNA (2007).

* ** ***Tayloria lingulata* (Dicks.) Lindb.**

First record: 1973. Sporadic; on damp soil or humus in willow-sedge hummock of late snow-melt areas, from upper subalpine through the alpine; arctic-alpine.

Beartooth Butte: [Hwy 212], swales around small lakes, subalpine zone between Long Lake and lower Shepherd Lake, 1973, 2900 m.s.m., *Weber B-44275* (COLO); Fantan North Fen (Heidel et al. 2008); Little Bear Lake Fen, 2008, 9600 ft, 2897, S+; Meadow Lake Fen, 2008, 9850 ft, 3799, S+. **Deep Lake:** unnamed alpine lake along Hwy 212, 2010, 10,000 ft, 8244, S+.

Note: A minerotrophic species with predominantly arctic distribution; disjunct on the Beartooth Plateau,

rare in Wyoming (Kosovich-Anderson unpublished data).

**** Thuidium recognitum** (Hedw.) Lindb.

First record: 2008. Rare, single collection from montane zone.

Muddy Creek: SE edge of Lily Lake Fen, swampy forest, *Picea glauca*/*Alnus* sp./*Linnaea borealis* L. (+ Bryidae / mosses), in shade under recently fallen spruce, forms carpet on duff and humus, locally abundant, assoc.: *Marchantia polymorpha* subsp. *montivagans*, *Aulacomnium palustre*, *Climacium dendroides*, *Rhizomnium pseudopunctatum*, *Timmia austriaca* Hedw., 2008, 7750 ft, 3047 (COLO).

Note: A circumboreal species, disjunct in Wyoming, with the only known station – on the Beartooth Plateau (Kosovich-Anderson and Weber 2011, Kosovich-Anderson unpublished data).

Timmia austriaca Hedw.

First record: 1953. Frequent; on shaded creek banks and humus-covered surface of rocks in wet and swamp montane and subalpine coniferous forests; arctic-alpine.

Jim Smith Peak: W of Beartooth Butte, Crazy Creek CG, 1953, *Lawton 2035* (WTU); Crazy Creek, W of Beartooth Lake, 1953, *Conard s.n.* (PH); Crazy Creek-2, 2010, 6900 ft, 7991, S+. **Muddy Creek:** Lake Creek Waterfalls, 2009, 7500 ft, 5812; Muddy Creek-1, 2009, 8100 ft, 6136; tributary of Beartooth Creek-1, 2010, 8450 ft, 7104; Ghost Creek, 2010, 7900 ft, 8437. **Beartooth Butte:** Clay Butte Fen, 2008, 9000 ft, 2928; Beartooth Lake: W shore, 2010, 8900 ft, 6640. **Deep Lake:** Sawtooth Lake, 2009, 9300 ft, 6048.

Timmia megapolitana Hedw.

- **subsp. bavarica** (Hessl.) Brassard

First record: 2009. Rare, single collection from subalpine zone.

Beartooth Butte: SE slope of Beartooth Butte, limestone debris scattered across the slope, in rock crevice, assoc.: *Distichium capillaceum*, 2009, 9250 ft, 5275, S+.

Note: Capsules are smaller than in genus description provided in FNA (2007, p. 166): $2.5\text{--}3 \times 1\text{--}1.5$ mm vs. $2\text{--}2.2 \times 0.9\text{--}1$ mm in the Beartooth specimen.

Tomentypnum nitens (Hedw.) Loeske

First record: 1953. Common; on boggy soil in minerotrophic (open or forested) fens and willow cars, from foothills through the upper subalpine.

Jim Smith Peak: Little Moose Peatlands, 2002, 7960 ft, *Jackson s.n.* (RM), det. J. Harpel; Crazy Creek CG Swamp, 2008, 7000 ft, 3183. **Muddy Creek:** East Lily Peatland, 2002, 8100 ft, *Jackson s.n.* (RM), det. J. Harpel; Ghost Creek Fen (Heidel et al. 2008); Lily Lake Swamp Forest, 2008, 7750 ft, 3019; Ghost Creek Fen, 2008, 7900 ft, 3734; outlet of Lily Lake, 2010, 7750 ft, 7514. **Beartooth Butte:** Beartooth Lodge, near stream, 1953, *Lawton 1934* (WTU); [Hwy 212], swales around small lakes, subalpine zone between Long Lake and lower Shepherd Lake, 1973, 2900 m.s.m., *Weber B-44285* (COLO,

RM); Clay Butte Fen (Heidel et al. 2008); Meadow Lake Fen, 2008, 9850 ft, 3793. **Deep Lake:** Sawtooth Lake, 2009, 9250 ft, 5978; Top Lake Fen-2, 2010, 9500 ft, 7721. **Black Pyramid Mountain:** WY-MT state line: unnamed lake, 2010, 9650 ft, 8063 (MONTU).

Tortella fragilis (Drumm.) Limpr.

First record: 1953. Frequent; on loamy soil in alpine tundra, on rocky ridgecrests and margins of solifluction lobes, in late snow-melt areas; arctic-alpine.

Jim Smith Peak: W of Beartooth Butte, Crazy Creek CG, 1953, *Lawton 2027* (WTU). **Deep Lake:** [Hwy 212], alpine bogs of E summit, head of Wyoming Creek, 1973, 3250 m.s.m., *Weber B-44263* (COLO, RM), det. R. Zander; summits: alpine tundra-3, 2008, 10,350 ft, 2409; dry creek in alpine tundra, 2008, 10,350 ft, 2420 (CAS); summits: Overlook Roadside Park, alpine tundra, 2008, 10,950 ft, 3547; summits: alpine tundra-7, 2010, 10,800 ft, 6718 (US), det. R. Ireland; summits: alpine tundra-9, 2010, 10,400 ft, 8112. **Black Pyramid Mountain:** summits: alpine tundra-4, 2008, 10,300 ft, 2470; summits: alpine fen-3, 2008, 10,100 ft, 2524.

Tortella tortuosa (Schrad. ex Hedw.) Limpr.

First record: 2008. Rare, single collection from alpine zone; arctic-alpine.

Deep Lake: summits: alpine fen-1, at base of granite rock, in shade, assoc.: *Tortella fragilis*, 2008, 10,500 ft, 2298.

Tortula hoppeana (Schultz) Ochyra

[*Desmatodon latifolius* (Hedw.) Brid.]

First record: 1939. Common; on loamy and rocky soil in subalpine and alpine meadows and tundra, on bare soil on trailsides; arctic-alpine. Sporophytes common.

Beartooth Butte: near Beartooth Lodge, 1939, *unknown s.n.* (WTU); near Beartooth Lodge, along stream, 1953, *Lawton 1933* (WTU); E of Beartooth Lake, Beartooth Pass, 1953, *Lawton s.n.* (MO). **Deep Lake:** [Hwy 212], E of summit near small glacial lake, 1953, 10,500 ft, *Lawton 1967* (WTU); near Frozen Lake at curve of Rd, 1953, 10,264 ft, *Lawton 2135* (WTU); [Hwy 212], W summit of Beartooth, tundra above Black Stone Lake, 1973, 3300 m.s.m., *Weber B-44251* (COLO, RM); Sawtooth Palsa Fen (Heidel et al. 2008); dry creek in alpine tundra, 2008, 10,350 ft, 2429 (MO), S+; inlet of Frozen Lake, 2008, 10,500 ft, 2586, S+; Littlerock Creek Fen, 2008, 10,650 ft, 3666; Sawtooth Palsa Fen, 2009, 9700 ft, 5761, S+; W summit and vicinity, 2010, 11,050 ft, 6695; Hwy 212, roadside granite debris, 2010, 10,200 ft, 6732, S+; summits: alpine tundra-11, 2010, 10,750 ft, 8157, S+; Gardner Lake: head of USFS Trail, 2010, 10,600 ft, 8189.

Tortula inermis (Brid.) Mont.

First record: 2008. Rare, single collection from subalpine zone.

Beartooth Butte: Beartooth Butte, on limestone rock along creek bank, 2008, ! 9500 ft (2900 m), 3839.

Note: Altitudinal update – 2900 m vs. “low to high elevations (0–2000 m)” (FNA 2007, p. 600).

* **Tortula leucostoma** (R.Br.) Hook. & Grev.

[*Desmatodon leucostoma* (R.Br.) Berggr.]

First record: 2008. Rare, single collection from alpine zone; arctic-alpine.

Deep Lake: Littlerock Creek Fen, ecotone zone of alpine *Salix planifolia*/Bryidae fen and alpine tundra, on frost boils, locally abundant, 2008, 10,650 ft, 3610, S+.

Tortula mucronifolia Schwägr.

First record: 2008. Rare, from montane through the alpine; arctic-alpine.

Beartooth Butte: tributary of Beartooth Creek-2, on soil over granite outcrop, 2010, 7750 ft, 7397, S+.

Deep Lake: summits: alpine tundra-6, on loamy soil, 2008, ! 10,850 ft (3310 m), 3343, S+.

Note: Altitudinal update – 3310 m vs. “low to high elevations (0–2700 m)” (FNA 2007, p. 601).

Tortula obtusifolia (Schwägr.) Mathieu

[*Desmatodon obtusifolius* (Schwägr.) Schimp.]

First record: 2009. Sporadic; on soil and rock (granite, limestone) in fens, meadows and tundra, in zone of late snowmelt at subalpine and alpine elevations.

Muddy Creek: seepage slope along Hwy 212, 2009, 8700 ft, 6104. **Beartooth Butte:** Beartooth Lake CG: wet subalpine meadow, 2009, 8950 ft, 4889; Beartooth Butte-1, 2009, 9250 ft, 5266; boggy valley NE of Fantan Lake, 2010, 9500 ft, 6831. **Deep Lake:** Gravel Pit vicinity, alpine tundra, 2010, 10,400 ft, 7265.

* **Trichostomum tenuirostre** (Hook. & Taylor) Lindb.

[*Oxystegus tenuirostris* (Hook. & Taylor) A.J.E.-Smith]

First record: 2009. Rare, in foothills and montane zone.

Jim Smith Peak: Crazy Creek-2, on granite outcrops in splash zone of creek, 2010, 6900 ft, 7976. **Muddy Creek:** Lake Creek Waterfalls, on inundated rocks, in shade of spruce, 2009, 7500 ft, 5828 (MHA, MO), ver. M. Ignatov.

* **Warnstorfia fluitans** (Hedw.) Loeske

[*Drepanocladus fluitans* (Hedw.) Warnst.].

First record: 1953. Frequent; in swales of fens, pools, stagnant water of streams, from montane through the alpine.

Muddy Creek: Mud Lake Fen, 2008, 7750 ft, 3117.

Beartooth Butte: between summit and Beartooth Lake, along Hwy, 1953, *Welch 16652* (WTU); E of Beartooth Lake, Beartooth Pass, *Lawton s. n.* (MO).

Deep Lake: 13 mi E of Beartooth Lake, 1953, 10,500 ft, *Conard, s.n.* (WTU); [Hwy 212], head of Wyoming Creek, alpine bogs of E summit, 1973, 3240 m.s.m., *Weber B-44265* (COLO); inlet of Frozen Lake, 2008,

10,400 ft, 2612; summits: alpine fen-4, 2008, 10,400 ft, 3281; Wyoming Creek-2, 2009, 10,500 ft, 5079 (MHA, MO), det. M. Ignatov.

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APPENDIX 1

TAXONOMIC DIVERSITY OF BRYOPHYTE FLORA OF THE WYOMING’S BEARTOOTH PLATEAU

Family	Genus (# of species in genus)	# of species in family
Hepaticae / Marchantiophyta		
Anastrophyllaceae	<i>Barbilophozia</i> (3), <i>Gymnocolea</i> (1), <i>Schljakovia</i> (1)	5
Aneuraceae	<i>Riccardia</i> (2)	2
Antheliaceae	<i>Anthelia</i> (1)	1
Blepharostomataceae	<i>Blepharostoma</i> (1)	1
Calypogeiaceae	<i>Calypogeia</i> (1)	1
Cephaloziaceae	<i>Cephalozia</i> (1), <i>Fuscocephaloziopsis</i> (2)	3
Cephaloziellaceae	<i>Cephaloziella</i> (2)	2
Cleveaceae	<i>Clevea</i> (1)	1
Conocephalaceae	<i>Conocephalum</i> (1)	1
Gymnomitriaceae	<i>Nardia</i> (1)	1
Harpanthaceae	<i>Harpanthus</i> (1)	1
Jungermanniaceae	<i>Jungermannia</i> (2)	2
Lepidoziaceae	<i>Lepidozia</i> (1)	1
Lophocoleaceae	<i>Chiloscyphus</i> (2), <i>Lophocolea</i> (2)	4
Marchantiaceae	<i>Marchantia</i> (1)	1
Pelliaceae	<i>Apopellia</i> (1), <i>Pellia</i> (1)	2
Plagiochilaceae	<i>Plagiochila</i> (1)	1
Radulaceae	<i>Radula</i> (1)	1
Scapaniaceae	<i>Lophozia</i> (3), <i>Saccobasis</i> (1), <i>Scapania</i> (7), <i>Schistochilopsis</i> (1), <i>Tritomaria</i> (1)	13
Solenostomataceae	<i>Solenostoma</i> (1)	1
Total (Hepaticae): 20	29	45
Musci / Bryophyta		
Amblystegiaceae	<i>Amblystegium</i> (1), <i>Calliergonella</i> (1), <i>Campyliadelphus</i> (1), <i>Campylium</i> (2), <i>Campylophyllum</i> (1), <i>Cratoneuron</i> (1), <i>Drepanocladus</i> (3), <i>Hygroamblystegium</i> (1), <i>Hygrohypnum</i> (7), <i>Leptodictyum</i> (1), <i>Palustriella</i> (1), <i>Platydictya</i> (1), <i>Pseudocalliergon</i> (2), <i>Sanionia</i> (2), <i>Tomentypnum</i> (1)	26
Aulacomniaceae	<i>Aulacomnium</i> (1)	1
Bartramiaceae	<i>Bartramia</i> (1), <i>Philonotis</i> (3)	4
Brachytheciaceae	<i>Brachytheciastrum</i> (2), <i>Brachythecium</i> (11), <i>Eurhynchiastrum</i> (1), <i>Homalothecium</i> (1), <i>Sciuro-hypnum</i> (4)	19

APPENDIX 1
CONTINUED

Family	Genus (# of species in genus)	# of species in family
Bryaceae	<i>Anomobryum</i> (1), <i>Bryum</i> (1), <i>Gemmabryum</i> (1), <i>Imbribryum</i> (1), <i>Plagiobryum</i> (1), <i>Ptychostomum</i> (9), <i>Rosulabryum</i> (3)	17
Calliergonaceae	<i>Calliergon</i> (3), <i>Sarmentypnum</i> (2), <i>Scorpidium</i> (3), <i>Srtraminergon</i> (1), <i>Warnstorfia</i> (1)	10
Climaciaceae	<i>Climacium</i> (2)	2
Dicranaceae	<i>Campylopus</i> (1), <i>Cynodontium</i> (1), <i>Dichodontium</i> (1), <i>Dicranella</i> (3), <i>Dicranoweisia</i> (2), <i>Dicranum</i> (6), <i>Kiaeria</i> (2), <i>Oncophorus</i> (2), <i>Paraleucobryum</i> (1)	19
Ditrichaceae	<i>Ceratodon</i> (1), <i>Distichium</i> (2), <i>Ditrichum</i> (2), <i>Saelania</i> (1)	6
Encalyptaceae	<i>Encalypta</i> (3)	3
Fissidentaceae	<i>Fissidens</i> (2)	2
Fontinalaceae	<i>Dichelyma</i> (1), <i>Fontinalis</i> (3)	4
Funariaceae	<i>Funaria</i> (1)	1
Grimmiaceae	<i>Bucklandiella</i> (1), <i>Coscinodon</i> (1), <i>Grimmia</i> (12), <i>Niphotrichum</i> (1), <i>Schistidium</i> (7)	22
Helodiaceae	<i>Elodium</i> (1)	1
Hylocomiaceae	<i>Hylocomium</i> (1), <i>Pleurozium</i> (1)	2
Hypnaceae	<i>Hypnum</i> (5), <i>Isopterygiopsis</i> (1), <i>Ptilium</i> (1)	7
Leskeaceae	<i>Pseudoleskea</i> (2), <i>Pseudoleskeella</i> (1)	3
Meesiaceae	<i>Amblyodon</i> (1), <i>Leptobryum</i> (1), <i>Meesia</i> (3), <i>Paludella</i> (1)	6
Mielichhoferiaceae	<i>Pohlia</i> (11)	11
Mniaceae	<i>Mnium</i> (6), <i>Plagiomnium</i> (2), <i>Rhizomnium</i> (4)	12
Orthotrichaceae	<i>Amphidium</i> (1), <i>Orthotrichum</i> (4)	5
Plagiotheciaceae	<i>Plagiothecium</i> (1)	1
Polytrichaceae	<i>Meiotrichum</i> (1), <i>Pogonatum</i> (1), <i>Polytrichastrum</i> (3), <i>Polytrichum</i> (4)	9
Pottiaceae	<i>Barbula</i> (1), <i>Bryoerythrophyllum</i> (1), <i>Didymodon</i> (4), <i>Molendoa</i> (1), <i>Syntrichia</i> (7), <i>Stegonia</i> (1), <i>Tortella</i> (2), <i>Tortula</i> (5), <i>Trichostomum</i> (1)	23
Pterigynandraceae	<i>Myurella</i> (1), <i>Pterigynandrum</i> (1)	2
Rhytidiaceae	<i>Rhytidium</i> (1)	1
Scouleriaceae	<i>Scouleria</i> (1)	1
Seligeriaceae	<i>Blindia</i> (1)	1
Sphagnaceae	<i>Sphagnum</i> (10)	10
Splachnaceae	<i>Tayloria</i> (1), <i>Splachnum</i> (1)	2
Thuidiaceae	<i>Abietinella</i> (1), <i>Thuidium</i> (1)	2
Timmiaceae	<i>Timmia</i> (2)	2
Total (Musci): 33	102	237
Total: 53	131	282

APPENDIX 2

EXCLUDED TAXA

The following 10 unaccepted taxa were present in the original lists (Kosovich-Anderson 2011a, 2015). These taxa have been designated unconfirmed, or unrecognized as separate taxa, or recently excluded from the *Flora of North America North of Mexico* (FNA 2014) and Synopsis of Liverwort Flora of North America North of Mexico (Stotler and Crandall-Stotler 2017).

HEPATICAE

Jungermannia exsertifolia Steph. subsp. *exsertifolia*. This subspecies is restricted to Japan, Korea, and China (Stotler and Crandall-Stotler 2017). The original report was based on erroneous identification.

Marchantia polymorpha L. subsp. *polymorpha*. Temporarily (?) excluded. Taxon with unclear distribution in North America; electrophoretically confirmed only from Europe (Stotler and Crandall-Stotler 2017).

Plectocolea subelliptica (Lindb. ex Heeg) A.Evans. The taxon was synonymized with *Solenostoma obovatum* (Nees) C.Massal. (Stotler and Crandall-Stotler 2017).

MUSCI

Amblystegium juratzkanum Schimp. [*A. serpens* (Hedw.) Bruch & Schimp. var. *juratzkanum* (Schimp.) Rau & Hervey]. The taxon was synonymized with *A. serpens* in *Flora of North America North of Mexico* (FNA 2014).

Aulacomnium androgynum (Hedw.) Schwägr. Specimens YKA 2655, 2671, 6052 & 7034 were redetermined by the author in 2020 as a stunted form of *A. palustre*.

Aulacomnium palustre var. *imbricatum* Bruch & Schimp. Excluded from *Flora of North America North of Mexico* (FNA 2014); taxonomic position of the variety is still controversial.

Hypnum cupressiforme Hedw. Specimens have been misidentification of *H. vaucheri*. The most reliable distinguishing feature of these species is the blunt foliose pseudoparaphyllia of *H. vaucheri*, filamentous to lanceolate in *H. cupressiforme*.

Palustriella decipiens (DeNot.) Ochyra [Cratoneuron *decipiens* (DeNot.) Loeske]. Excluded from *Flora of North America North of Mexico* (FNA 2014).

Sarmentypnum tundrae (Arnell) Hedenäs. Previous report from Wyoming Creek (Kosovich-Anderson 2015) was based on incorrect identification of the specimen YKA 5087. Reevaluated by the author in 2020 as a short-leaved alpine form of *S. exannulatum*.

Sphagnum subsecundum Nees. Temporarily (?) excluded. According to Shaw et al. (2014), the geographic range of 'real' *S. subsecundum* is restricted to eastern North America and western Europe. However, some specimens from the Beartooth Plateau (e.g., 5311, 5312, 5313, 5618) morphologically strongly suggest typical *S. subsecundum*. These specimens need additional genetic investigations. I cannot rule out that *S. subsecundum* has wider distribution.

APPENDIX 3

COMMON BRYOPHYTES BY HABITAT

This research revealed a core set of bryophytes which are most commonly found in the following habitats on Wyoming's Beartooth Plateau:

alpine tundra (on soil, rock debris, stabilized talus, solifluction lobes, frost boils, snowbeds, glacial till): *Abietinella abietina*, *Barbilophozia hatcheri*, *Brachytheciastrum collinum*, *Bryum argenteum*, *Cephaloziella divaricata*, *Ceratodon purpureus*, *Dicranum muehlenbeckii*, *D. spadiceum*, *Didymodon asperifolius*, *Ditrichum flexicaule*, *Encalypta rhaptocarpa*, *Gemmabryum caespitium*, *Grimmia montana*, *Hypnum revolutum* s. l., *H. vaucheri*, *Mnium arizonicum*, *Orthotrichum laevigatum*, *Pohlia bolanderi*, *P. cruda*, *P. drummondii*, *Polytrichastrum alpinum* var. *septentrionale*, *P. sexangulare*, *Polytrichum juniperinum*, *P. piliferum*, *Ptychostomum inclinatum*, *Rhytidium rugosum*, *Rosulabryum elegans*, *Syntrichia norvegica*, *S. ruralis*, *Tortella fragilis*, *Tortula hoppeana*.

cliffs and ridgecrests: *Barbilophozia hatcheri*, *Bartramia ithyphylla*, *Blepharostoma trichophyllum*, *Brachytheciastrum collinum*, *Cephaloziella divaricata*, *Distichium capillaceum*, *Encalypta rhaptocarpa*, *Grimmia elatior*, *G. longirostris*, *G. montana*, *Hypnum revolutum* s. s., *H. vaucheri*, *Orthotrichum laevigatum*, *Polytrichastrum alpinum* var. *septentrionale*, *Polytrichum piliferum*, *Pseudoleskea radicata*, *Syntrichia ruralis*.

snow-melt rills and seepage slopes: *Brachythecium erythrorhizon* s. s., *Campylium stellatum*, *Dicranum muehlenbeckii*, *Distichium capillaceum*, *Drepanocladus aduncus*, *Gymnocolea inflata*, *Hygrohypnum duriusculum*, *H. ochraceum*, *Hypnum lindbergii*, *H. pratense*, *Marchantia polymorpha* subsp. *montivagans*, *Philonotis fontana* var. *pumila*, *Plagiomnium ellipticum*, *Pohlia wahlenbergii*, *Polytrichastrum alpinum* var. *septentrionale*, *P. sexangulare*, *Ptychostomum pseudotriquetrum*, *P. turbinatum*, *P. weigeli*, *Rhizomnium magnifolium*, *Sarmentypnum exannulatum*, *Scapania irrigua*, *Sciuro-hypnum latifolium*, *Syntrichia norvegica*.

alpine and subalpine fens and peaty banks of lakes: *Aulacomnium palustre*, *Barbilophozia hatcheri*, *Blepharostoma trichophyllum*, *Calliergon cordifolium*, *C. giganteum*, *Campylium stellatum*, *Cephaloziella bicuspidata*, *Cephaloziella divaricata*, *Ceratodon purpureus*, *Cratoneuron filicinum*, *Drepanocladus aduncus*, *Fuscocephaloziopsis pleniceps*, *Gymnocolea inflata*, *Hypnum lindbergii*, *H. pratense*, *Lophozia ventricosa* s. s., *Marchantia polymorpha* subsp. *montivagans*, *Oncophorus virens*, *Palustriella falcata*, *Philonotis fontana* s.

l., *Plagiomnium ellipticum*, *Pohlia cruda*, *P. wahlenbergii*, *Polytrichastrum alpinum* s. l., *P. longisetum*, *Polytrichum strictum*, *Ptychostomum pseudotriquetrum*, *P. weigeli*, *Rhizomnium magnifolium*, *R. pseudopunctatum*, *Rosulabryum elegans*, *Sanionia nivalis*, *S. uncinata*, *Sarmentypnum exannulatum*, *S. sarmentosum*, *Scapania irrigua*, *S. subalpina*, *Sciuro-hypnum latifolium*, *Scorpidium cossonii*, *Sphagnum platyphyllum*, *S. russowii*, *S. squarrosum*, *S. warnstorffii*, *Straminergon stramineum*, *Tomentypnum nitens*.

alpine and subalpine meadows: *Abietinella abietina*, *Aulacomnium palustre*, *Bryoerythrophyllum recurvirostrum*, *Calliergon cordifolium*, *Dicranum spadiceum*, *Hypnum lindbergii*, *Pohlia nutans*, *Polytrichastrum alpinum* s. l., *Polytrichum juniperinum*, *Pseudoleskea radicata*, *Ptychostomum* spp., *Sanionia uncinata*, *Schljakovia kunzeana*, *Syntrichia norvegica*, *S. ruralis*, *Tortula hoppeana*.

ponds, lakes, swales and pools in fens (submerged): *Calliergon giganteum*, *Drepanocladus aduncus*, *D. polygamus*, *Jungermannia exsertifolia* subsp. *cordifolia*, *Pohlia wahlenbergii*, *Sarmentypnum exannulatum*, *S. sarmentosum*, *Scorpidium cossonii*, *Sphagnum platyphyllum*, *Warnstorffia fluitans*.

creeks and streams: a) inundated /seasonally inundated rocks: *Brachythecium rivulare*, *Chiloscyphus pallescens*, *Cratoneuron filicinum*, *Dichelyma falcatum*, *Fontinalis antipyretica*, *Hygrohypnum duriusculum*, *H. ochraceum*, *Jungermannia exsertifolia* subsp. *cordifolia*, *Philonotis fontana* s. l., *Pseudoleskea radicata*, *Scapania irrigua*, *S. undulata*, *Schistidium* spp., *Scouleria aquatica*; **b) soil banks:** *Bartramia ithyphylla*, *Bryoerythrophyllum recurvirostrum*, *Conocephalum salebrosum*, *Cratoneuron filicinum*, *Ditrichum flexicaule*, *Fissidens bryoides*, *F. osmundioides*, *Leptobryum pyriforme*, *Meiotrichum lyallii*, *Mnium blyttii*, *M. thomsonii*, *Palustriella falcata*, *Pellia neesiana*, *Philonotis fontana* s. l., *Ptychostomum pallescens*, *P. pseudotriquetrum*, *P. weigeli*.

riparian willow communities and willow carrs: *Amblystegium serpens*, *Aulacomnium palustre*, *Campyliadelphus chrysophyllus*, *Climacium dendroides*, *Conocephalum salebrosum*, *Cratoneuron filicinum*, *Drepanocladus aduncus*, *D. polygamus*, *Elodium blandowii*, *Fissidens bryoides*, *F. osmundioides*, *Hygrohypnum ochraceum*, *Hypnum lindbergii*, *H. pratense*, *Marchantia polymorpha* subsp. *montivagans*, *Philonotis fontana* s. l., *Plagiomnium ellipticum*, *Pohlia bolanderi*, *P. wahlenbergii*, *Ptychostomum pseudotriquetrum*, *Sanionia uncinata*, *Sciuro-hypnum latifolium*, *Sphagnum russowii*, *S. squarrosum*, *Syntrichia norvegica*, *Timmia austriaca*.

mesic to wet forests (old-growth spruce-fir and pine-spruce-fir forests): a) forest floor (soil, duff): *Amblystegium serpens*, *Barbilophozia lycopodioides*, *Blepharostoma trichophyllum*, *Brachytheciastrum collinum*, *Brachythecium erythrorrhizon* s. s., *Climacium dendroides*, *Dicranum scoparium*, *Eurhynchiastrum pulchellum*, *Meiotrichum lyallii*, *Mnium arizonicum*, *M. marginatum*, *Pohlia cruda*, *Polytrichastrum alpinum* var. *septentrionale*, *Polytrichum juniperinum*, *Sanionia uncinata*, *Sciuro-hypnum oedipodium*, *Syntrichia norvegica*, *S. ruralis*; **b) decaying bark, wood and on tree bases:** *Amblystegium serpens*, *Barbilophozia hatcheri*, *Blepharostoma trichophyllum*, *Brachytheciastrum collinum*, *Ceratodon purpureus*, *Dicranoweisia crispula*, *Dicranum muehlenbeckii*, *D. scoparium*, *Hypnum revolutum* s. s., *Lophozia ventricosa* s. s., *Mnium arizonicum*, *Plagiothecium denticulatum*, *Ptychostomum pallescens*, *Syntrichia ruralis*; **c) seepage areas:** *Aulacomnium palustre*, *Marchantia polymorpha* subsp. *montivagans*, *Mnium blyttii*, *M. marginatum*, *M. thomsonii*, *Philonotis fontana*, *Plagiomnium ellipticum*, *Ptychostomum pseudotriquetrum*, *Rhizomnium magnifolium*, *Scapania irri-*

gua, *S. subalpina*, *Sciuro-hypnum latifolium*, *Scouleria aquatica*, *Timmia austriaca*; **d) rocks under the canopy of trees:** *Brachytheciastrum collinum*, *Dicranoweisia crispula*, *Grimmia elatior*, *G. longirostris*, *G. montana*, *Hypnum revolutum* s. s., *Orthotrichum laevigatum*, *O. rupestre*, *Pohlia drummondii*, *P. nutans*, *Pseudoleskea radicata*, *Sciuro-hypnum oedipodium*, *Syntrichia norvegica*, *S. ruralis*.

dry forests (open pine and aspen-pine woods, aspen groves and stands; mostly on rock outcrops and debris or in sheltered areas around rocks): *Brachytheciastrum collinum*, *Brachythecium erythrorrhizon* s. s., *Bryum argenteum*, *Ceratodon purpureus*, *Dicranoweisia cirrata*, *D. crispula*, *Encalypta rhaptocarpa*, *Grimmia elatior*, *G. montana*, *Hypnum revolutum* s. s., *Orthotrichum laevigatum*, *O. rupestre*, *Pohlia cruda*, *P. nutans*, *Polytrichum juniperinum*, *P. piliferum*, *Pseudoleskea radicata*, *Syntrichia norvegica*, *S. ruralis*.

xeric grasslands and shrublands (mostly beside or in crevices of rock outcrops and debris, and on soil under shrubs or on

sides of grass tussocks): *Bryum argenteum*, *Ceratodon purpureus*, *Gemmabryum caespitium*, *Grimmia montana*, *Hypnum revolutum* s. s., *Pohlia nutans*, *Polytrichum piliferum*, *Pseudoleskea radicata*, *Ptychostomum pallescens*, *Syntrichia ruralis*.

dry and open limestone rocks (mainly in crevices and on partially shaded ledges): *Brachytheciastrum collinum*, *Bryoerythrophyllum recurvirostrum*, *Distichium capillaceum*, *Grimmia anodon*, *Hypnum vaucheri*, *Syntrichia* spp., *Tortula* spp.

dry and open granite rocks (mainly in crevices and on partially shaded ledges): *Bryum argenteum*, *Dicranoweisia crispula*, *Grimmia alpestris*, *G. montana*, *Orthotrichum laeviganum*, *Hypnum revolutum* s. l., *Syntrichia ruralis*.

disturbed habitats (by human, animals or natural events): *Bryum argenteum*, *Ceratodon purpureus*, *Gemmabryum caespitium*, *Leptobryum pyriforme*, *Marchantia polymorpha* s. l., *Pohlia nutans*, *Polytrichum juniperinum*.

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